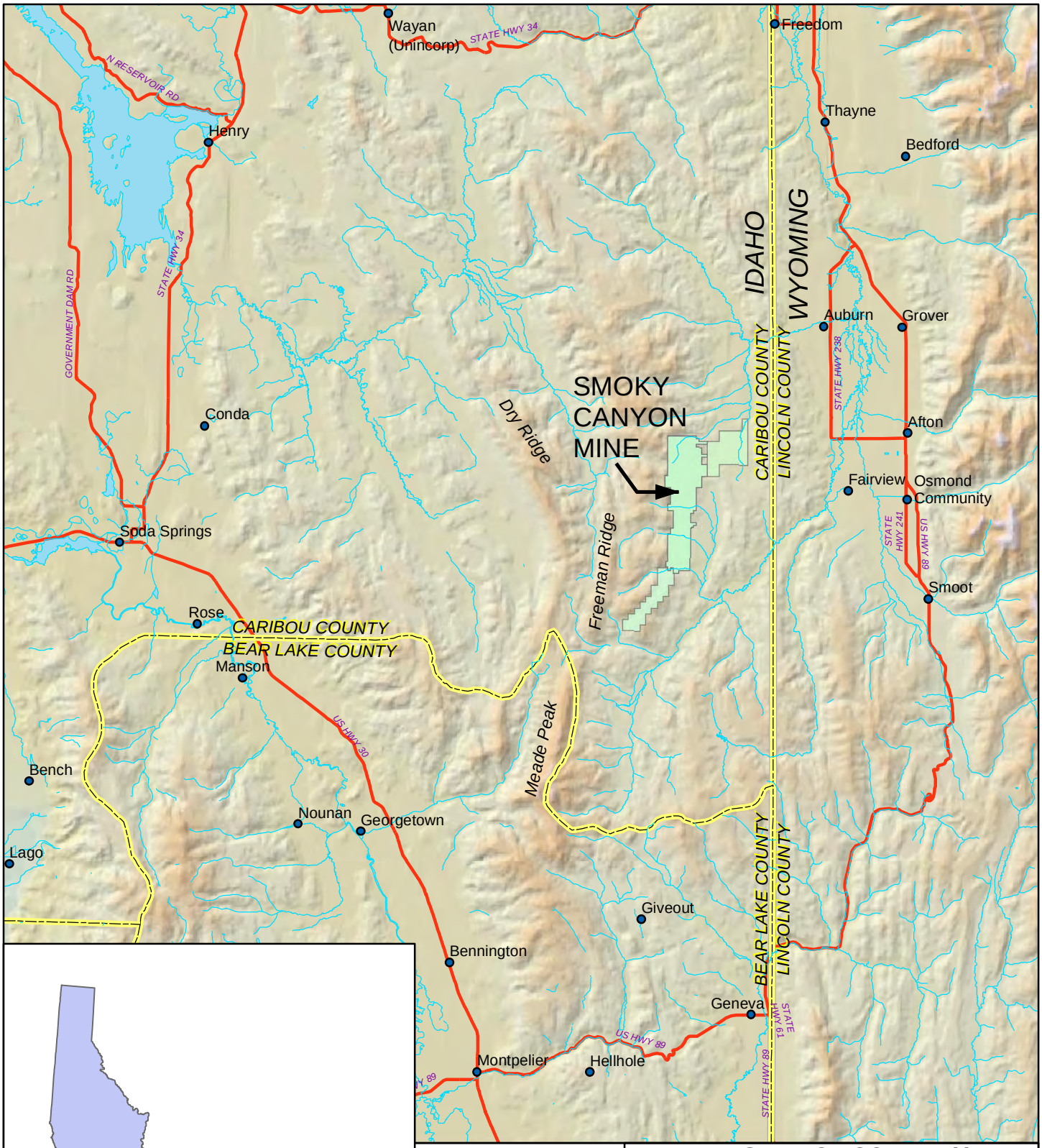


J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

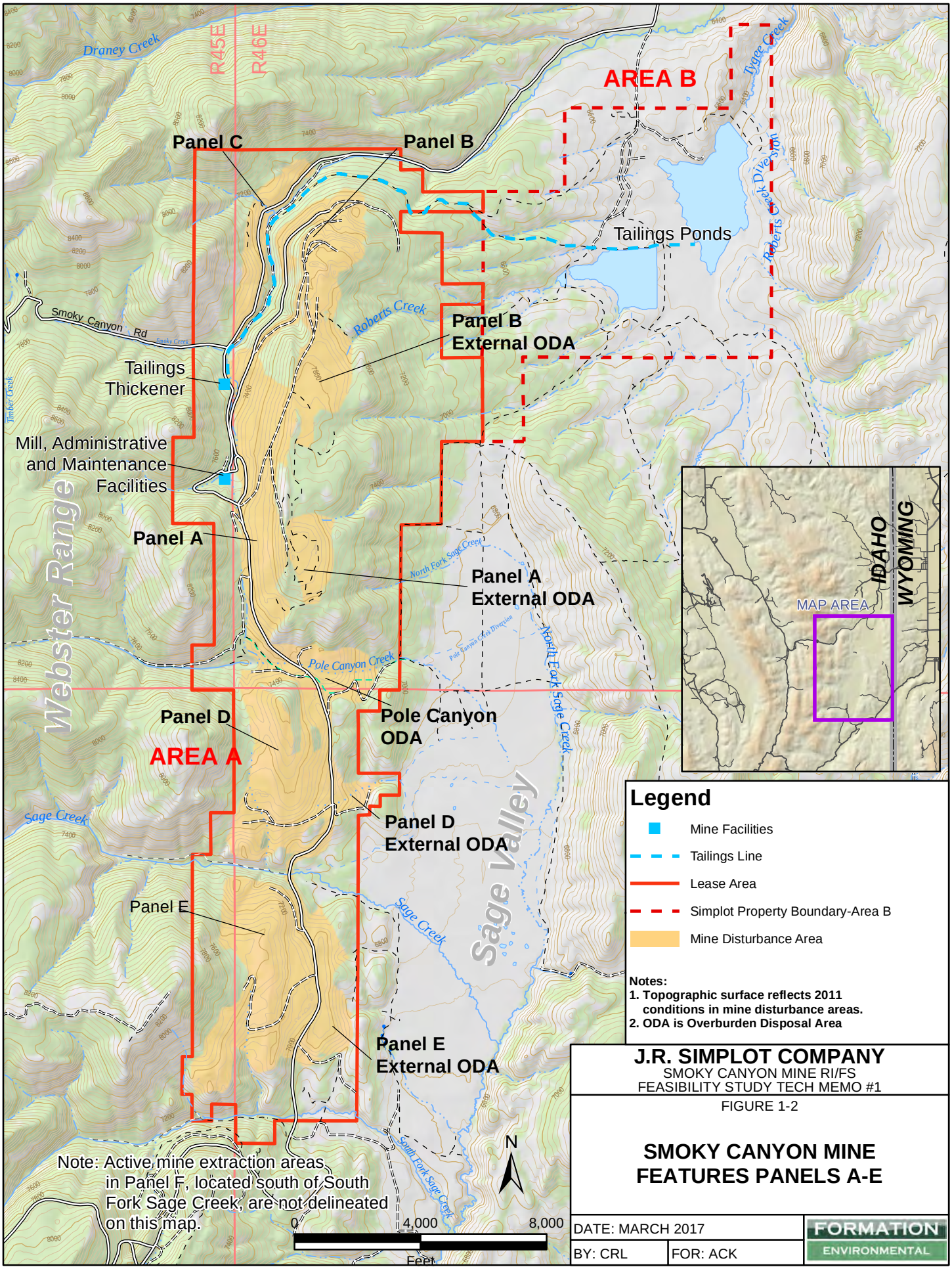
FIGURE 1-1

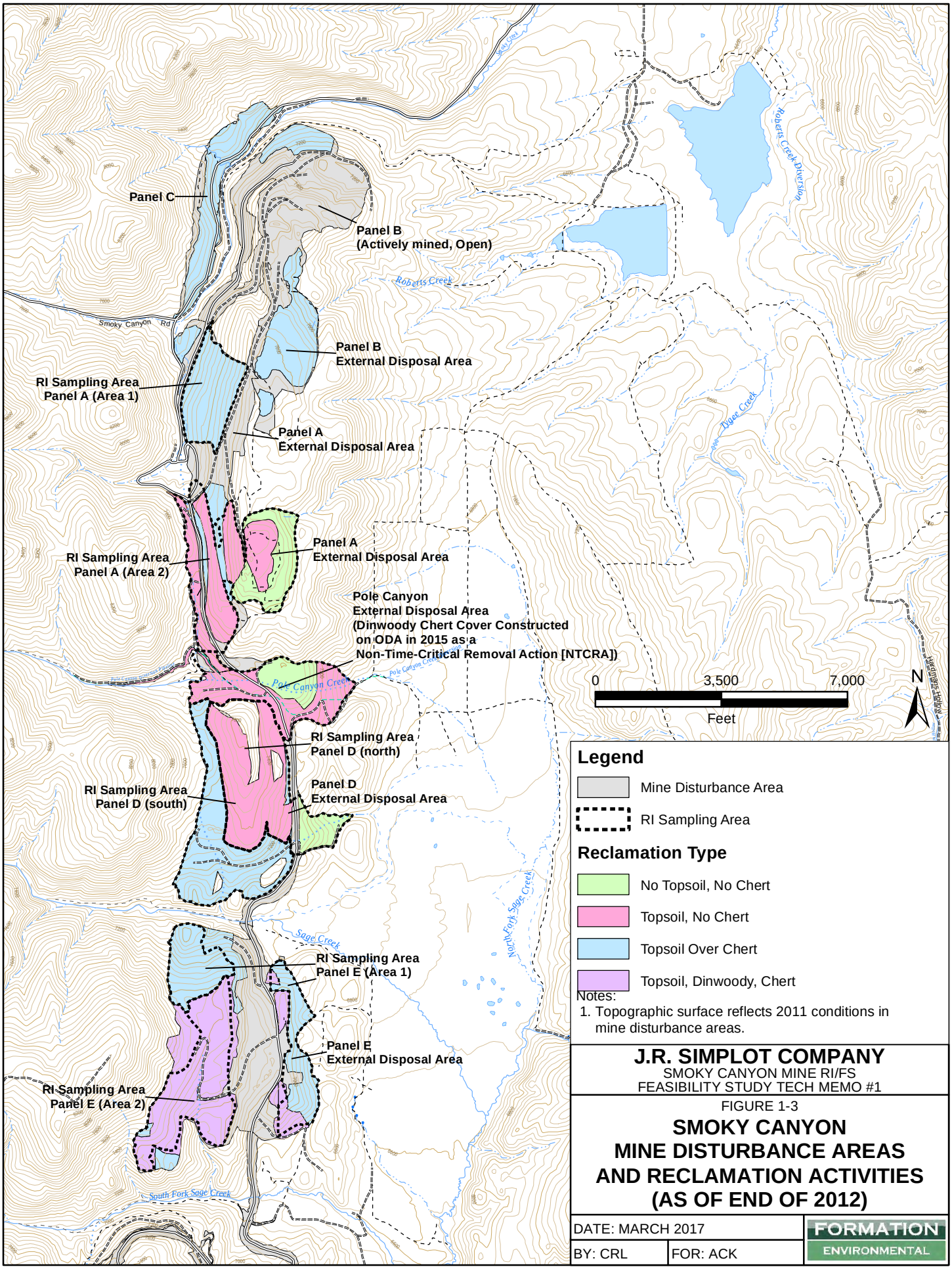
LOCATION OF THE SMOKY CANYON MINE

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig1_01_RgnLoc.mxd


Draney Creek
R45E
R46E
AREA B
Tygee Creek
Roberts Creek Diversion
Panel C
Panel B
Tailings Ponds
Smoky Canyon Rd
Roberts Creek
Panel B
External ODA
Tailings
Thickener
Timber Creek
Mill, Administrative
and Maintenance
Facilities
Webster Range
Panel A
North Fork Sage Creek
Panel A
External ODA
Pole Canyon Creek
Pole Canyon Area Diversion
North Fork Sage Creek
Pole Canyon
ODA
Panel D
AREA A
Sage Creek
Panel D
External ODA
Sage Valley
Panel E
Sage Creek
Panel E
External ODA
South Fork Sage Creek
IDAHO
WYOMING
MAP AREA
Legend
Mine Facilities
Tailings Line
Lease Area
Simplot Property Boundary-Area B
Mine Disturbance Area
Notes:
1. Topographic surface reflects 2011 conditions in mine disturbance areas.
2. ODA is Overburden Disposal Area
Note: Active mine extraction areas in Panel E, located south of South Fork Sage Creek, are not delineated on this map.
N
0
4,000
8,000
Feet
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1
FIGURE 1-2
SMOKY CANYON MINE
FEATURES PANELS A-E
DATE: MARCH 2017
BY: CRL
FOR: ACK
FORMATION ENVIRONMENTAL
S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig1_02_MineLoc.mxd



Notes:

1. Topographic surface reflects 2011 conditions in mine disturbance areas.

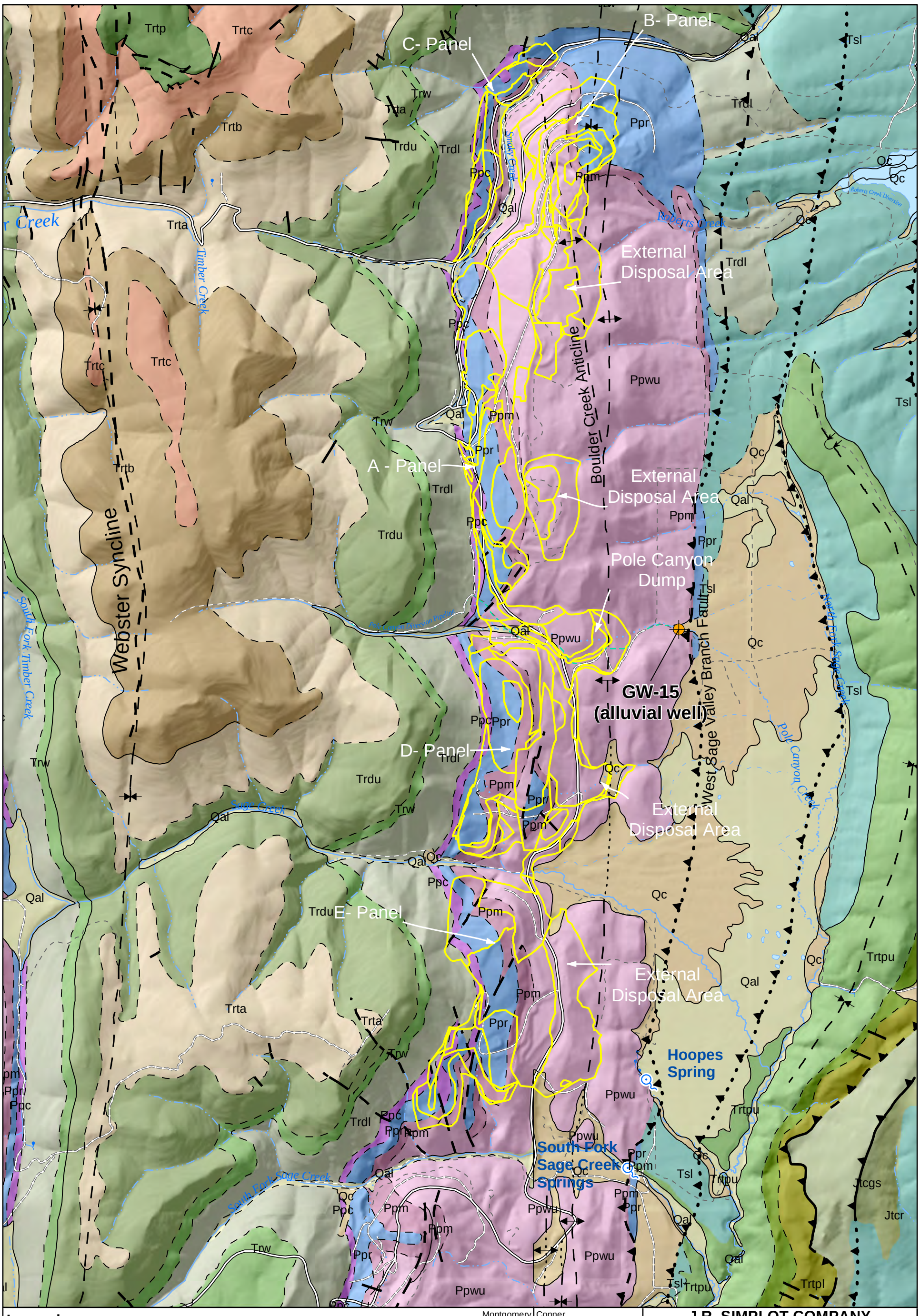
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 1-3

SMOKY CANYON MINE DISTURBANCE AREAS AND RECLAMATION ACTIVITIES (AS OF END OF 2012)

DATE: MARCH 2017	FORMATION ENVIRONMENTAL
BY: CRL	FOR: ACK

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig1_03_MineDis2012.mxd



Legend

Geologic Features

- Contact (Dashed where inferred, dotted where buried)
- Normal Fault (Dashed where inferred, dotted where buried)
- Thrust Fault (Dashed where inferred, dotted where buried)
- Syncline Axis
- Anticline Axis

Hydrology

- Perennial Stream
- Intermittent Stream

Mine Features

- Areas of Mine Disturbance

Montgomery & Cheney (1967) | Conner (1980)

See Figure 2.3-2 for Explanation of Geologic Map Units.

0 1,500 3,000

Feet

N

Geology:
Geology of the Sage Valley Quadrangle, Idaho-Wyoming. John L. Conner, BYU, 1980
Geology of the Stewart Flat Quadrangle, Caribou County, Idaho. Kathleen M. Montgomery and T. M. Cheney, USGS, 1967

Topography:
2011 aerial survey (shown as hillshade).

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-1

GEOLOGIC MAP OF SMOKY CANYON MINE AND VICINITY

DATE: MARCH 2017
BY: CRL | FOR: ACK

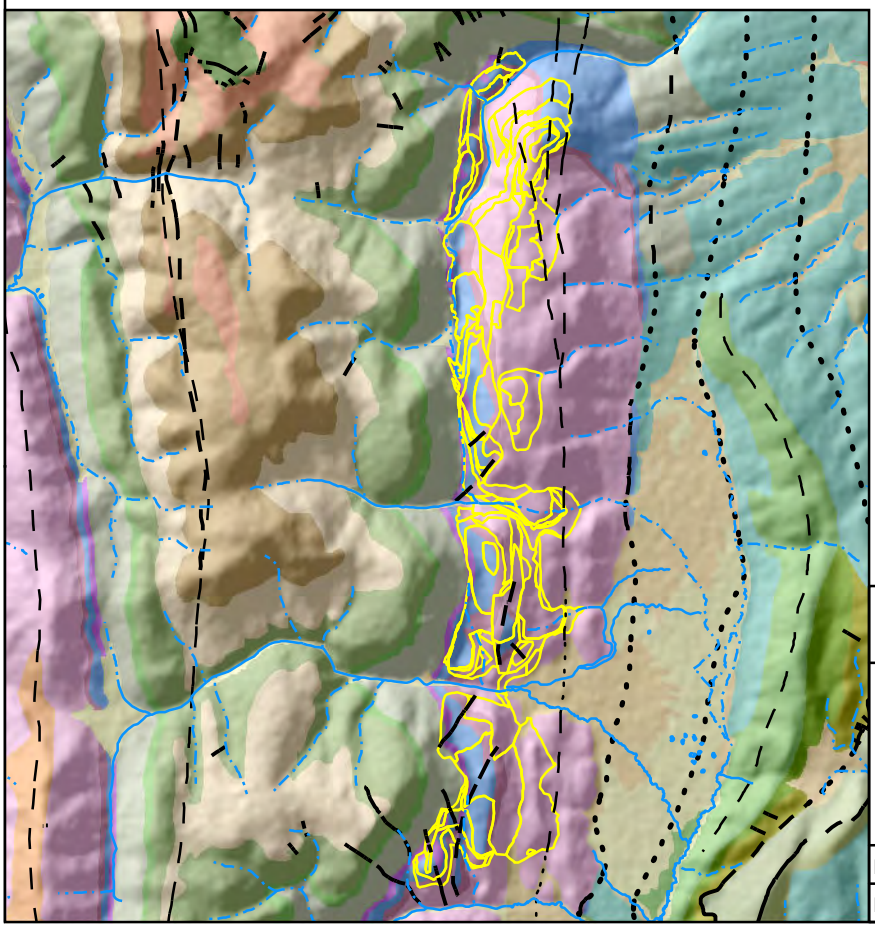
FORMATION ENVIRONMENTAL

S:\GIS\arcprj\2010109\pht\FS\TechMemo1\Fig2_01_geo.mxd

EXPLANATION FOR GEOLOGIC MAP

Geologic Map Units and Symbols

Age	Formation	Map Symbol	Description
Quaternary		Qt	Travertine
		Qc	Colluvium
		Qal	Alluvium
Tertiary	Salt Lake	Tsl	Salt Lake Formation
	Unconformity		
Jurassic	Nugget Sandstone	Jn	Nugget Sandstone
Triassic	Thaynes	Trtpu	Upper Portneuf Limestone Member
		Tral	Ankareh Formation - Lane Tongue
		Trtpl	Lower Portenuf Limestone Member
		Trtc	Thaynes C Member
		Trtb	Thaynes B Member
		Trta	Thaynes A Member
	Dinwoody	Trdu	Upper Dinwoody Formation
	Woodside	Trw	Woodside Formation
	Dinwoody	Trdl	Lower Dinwoody Formation
Permian	Phosphoria	Ppc	Cherty Shale Member
		Ppr	Rex Chert Member
		Ppm	Meade Peak Member
Pennsylvanian/Permian	Park City & Wells	Ppwu	Grandeur Member of Park City Formation and Upper Wells Formation
	Wells	Ppwl	Lower Wells Formation



Geologic Map Symbols

Contact (Dashed where inferred, dotted where buried)

Normal Fault (Dashed where inferred, dotted where buried)

Thrust Fault (Dashed where inferred, dotted where buried)

Syncline Axis

Anticline Axis

J.R. SIMPLOT COMPANY

SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-2

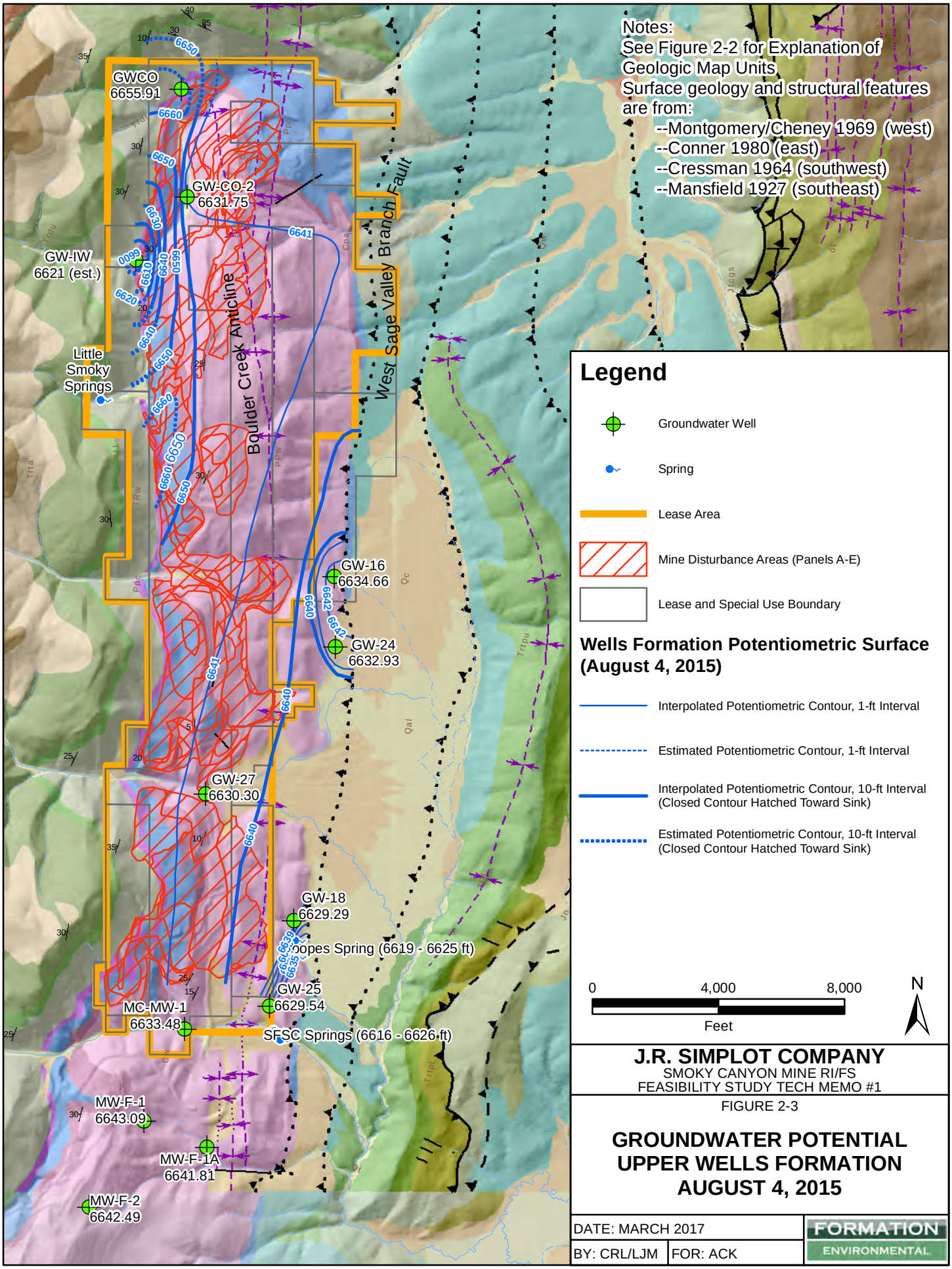
EXPLANATION FOR GEOLOGIC MAP

DATE: MARCH 2017

BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\20101009pit\FS\TechMemo1\Fig2_02_geounit.mxd



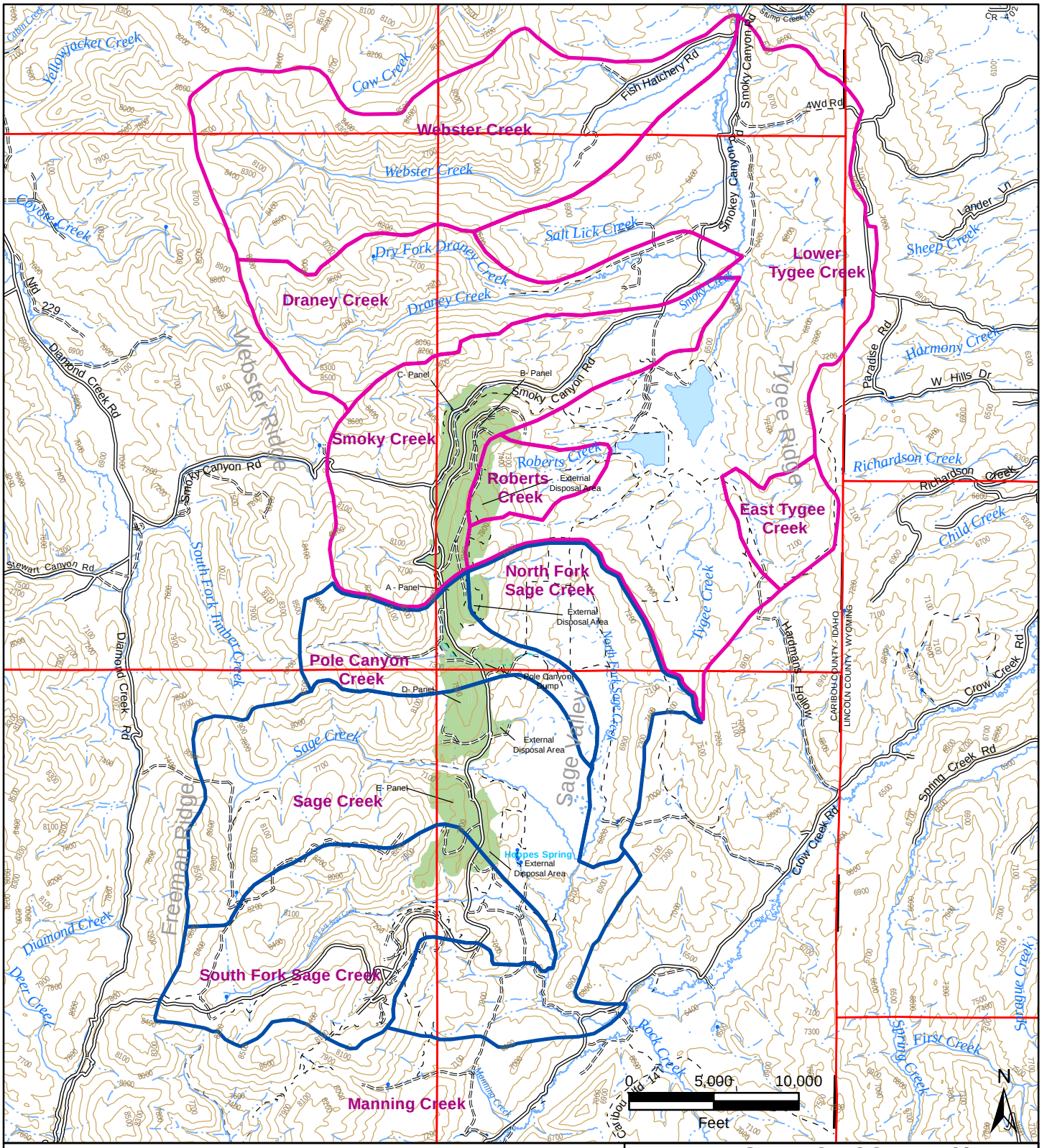
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-3

GROUNDWATER POTENTIAL UPPER WELLS FORMATION AUGUST 4, 2015

DATE: MARCH 2017	FORMATION ENVIRONMENTAL
BY: CRL/LJM	FOR: ACK

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig2_03_PotSurf_2015-08.mxd



Legend

- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Pipeline
- Historic Flow Path
- Canal Ditch
- Intemittent Stream
- Perennial Stream
- Lake/Pond
- Mine Disturbance

Watershed Features

- Sage Creek Basin (Drains to Crow Creek)
- Tygee Creek Basin (Drains to Stump Creek)

J.R. SIMPLOT COMPANY

SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

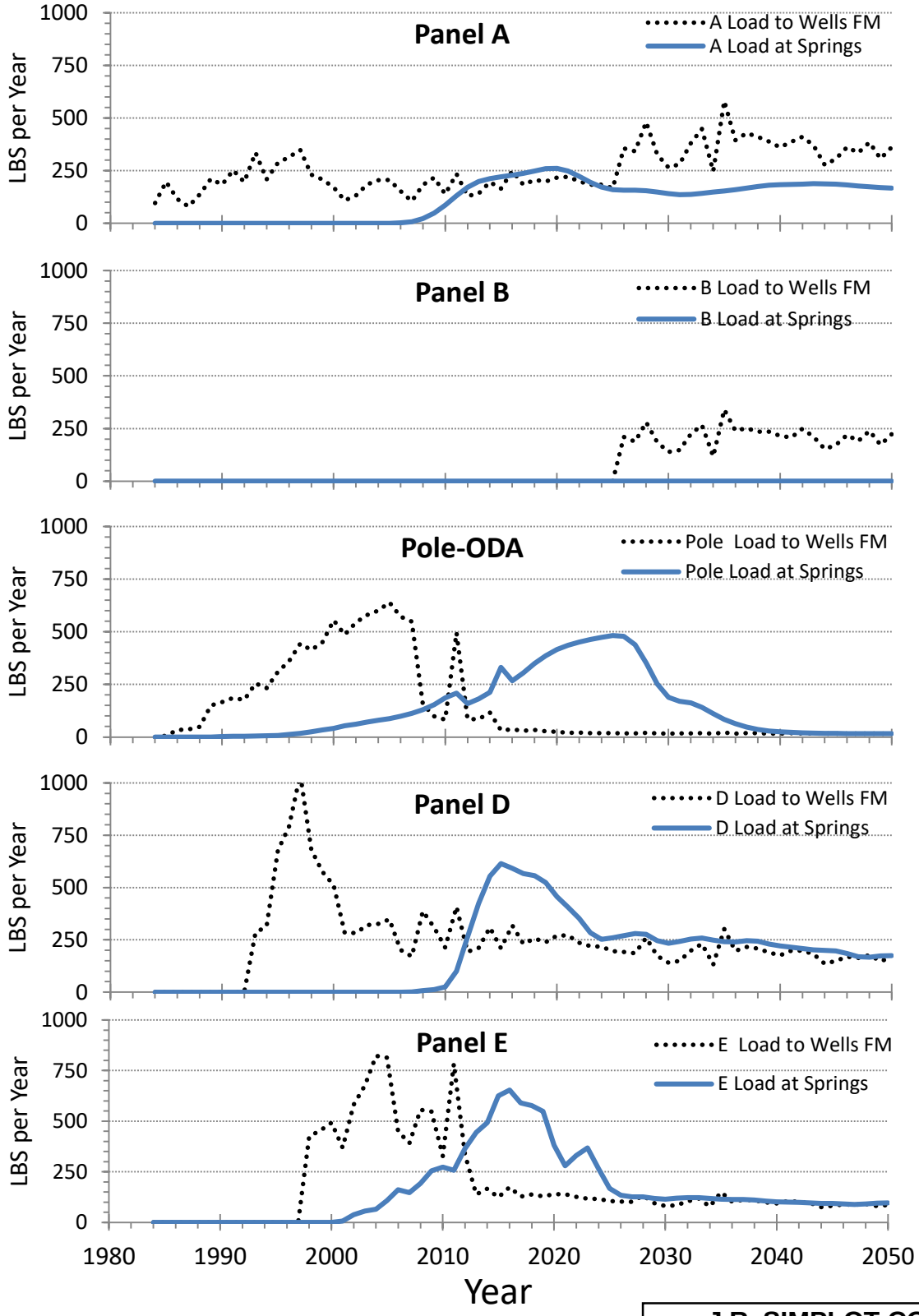
FIGURE 2-4

SMOKY CANYON MINE AND VICINITY HYDROLOGIC FEATURES

DATE: MARCH 2017	FORMATION ENVIRONMENTAL
BY: CRL	FOR: ACK

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig2_04_wshed.mxd

S:\Jobs\0442-004-900-Simplot-Smoky\FeasibilityStudy\FSTM1\Revised FSTM1\Figures\Fig2-5_SeMassLoad_rev.pptx



J.R. SIMPLOT COMPANY

SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-5

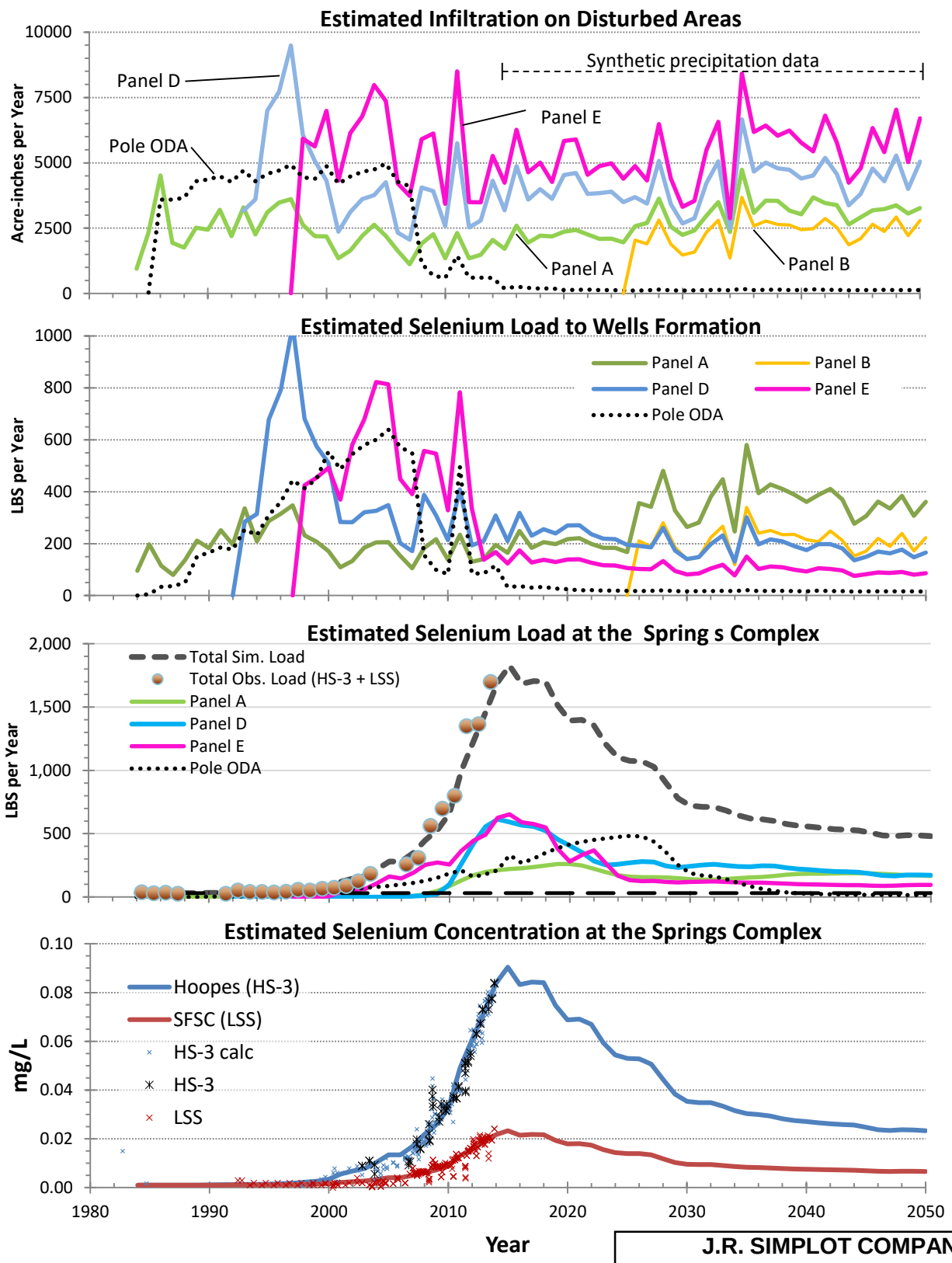
ESTIMATED SELENIUM MASS LOAD TO THE WELLS FORMATION AND ARRIVAL AT SPRINGS COMPLEX FOR EACH SOURCE AREA

DATE: MARCH 2017

BY: PHT | FOR: ACK

FORMATION ENVIRONMENTAL

S:\Jobs\0442-004-900-Simplot-Smoky\FeasibilityStudy\FSTM1\Revised%20FSTM1\Figures\Fig2-6_EstInfilration_rev.pptx



J.R. SIMPLOT COMPANY

SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

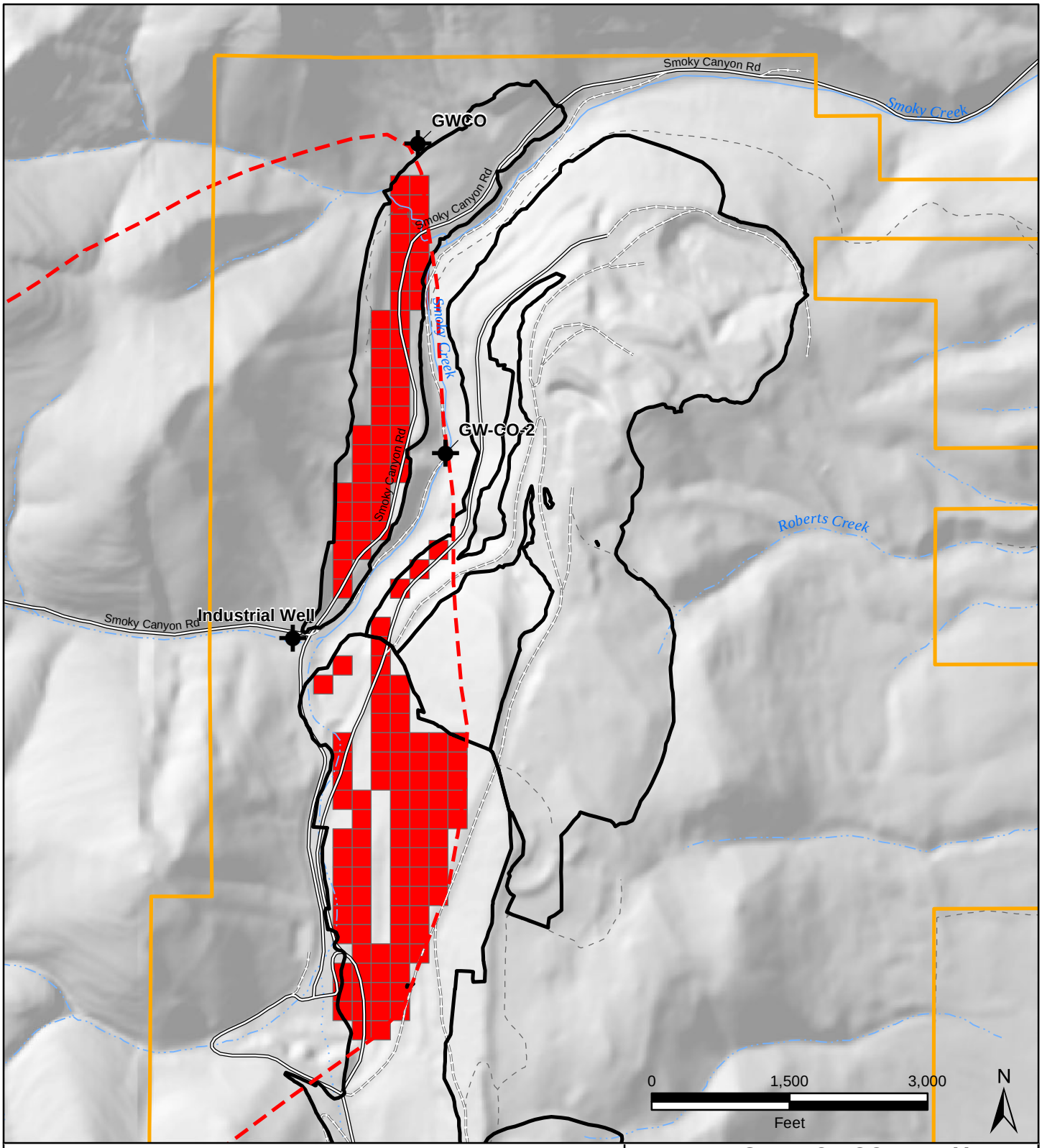
FIGURE 2-6

ESTIMATED INFILTRATION ON DISTURBERD AREAS, ESTIMATED SELENIUM LOADING TO WELLS FORMATION AND SPRINGS COMPLEX

DATE: MARCH 2017

BY: PHT | FOR: ACK

FORMATION ENVIRONMENTAL



Legend

- Groundwater Monitoring Locations
- Minor Road
- Unimproved Road
- Trail (4WD)
- Historic Flow Path
- Intemittent Stream
- Perennial Stream
- Lease Area
- Structural Influence
- Approximate Mine Panel Boundaries
- Backfilled Areas (Source Cells) v2

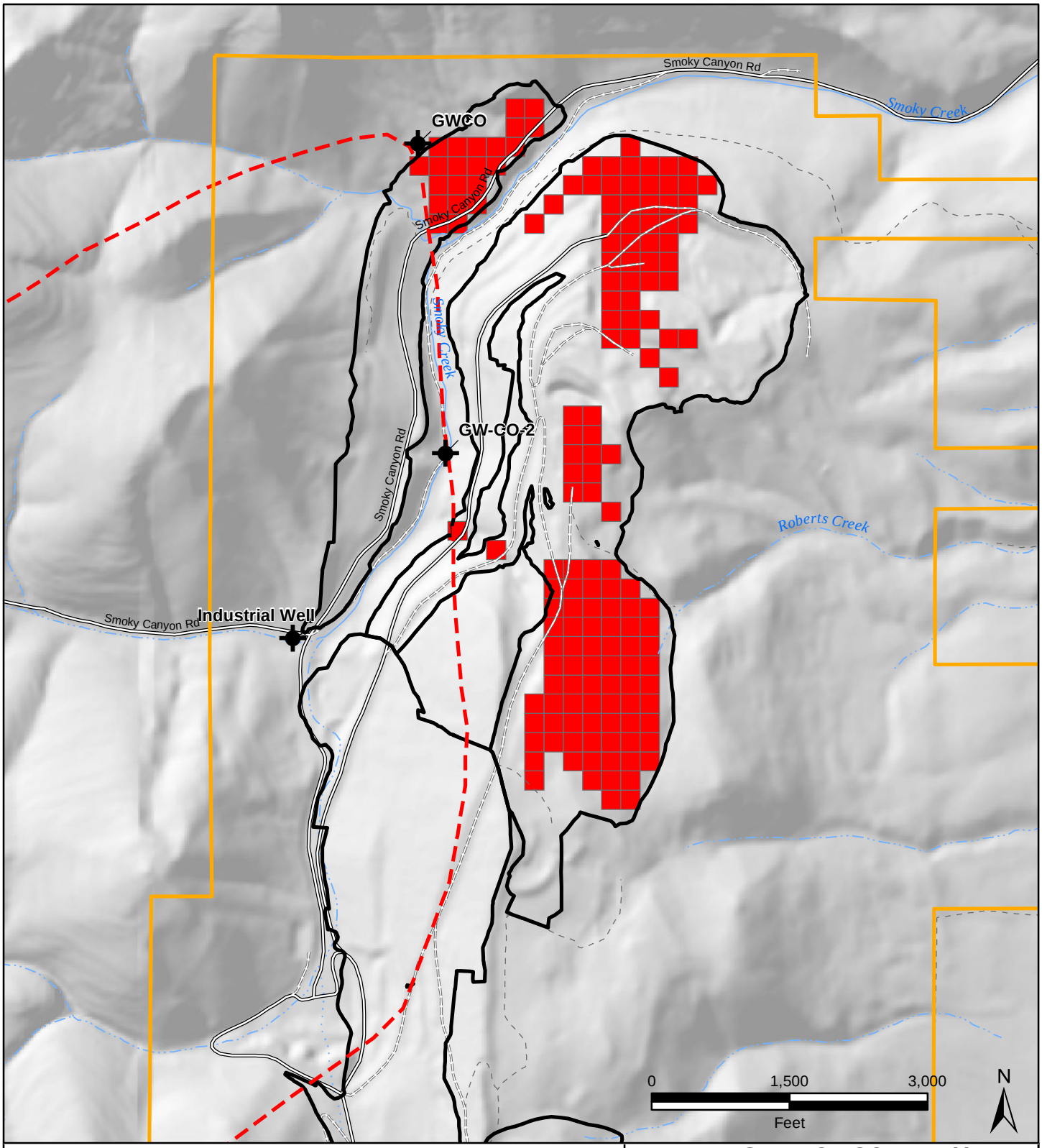
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-7

MODEL GRID CELLS REPRESENTING AREAS OF SELENIFEROUS BACKFILL (2012 CONDITIONS) INSIDE ASSUMED GW-IW CAPTURE ZONE

DATE: MARCH 2017	FORMATION ENVIRONMENTAL
BY:	FOR:

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig2_07_ModelGrid_v2_inside.mxd



Legend

- Groundwater Monitoring Locations
- Minor Road
- Unimproved Road
- Trail (4WD)
- Historic Flow Path
- Intemittent Stream
- Perennial Stream
- Lease Area
- Structural Influence
- Approximate Mine Panel Boundaries
- Backfilled Areas (Source Cells) v2

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

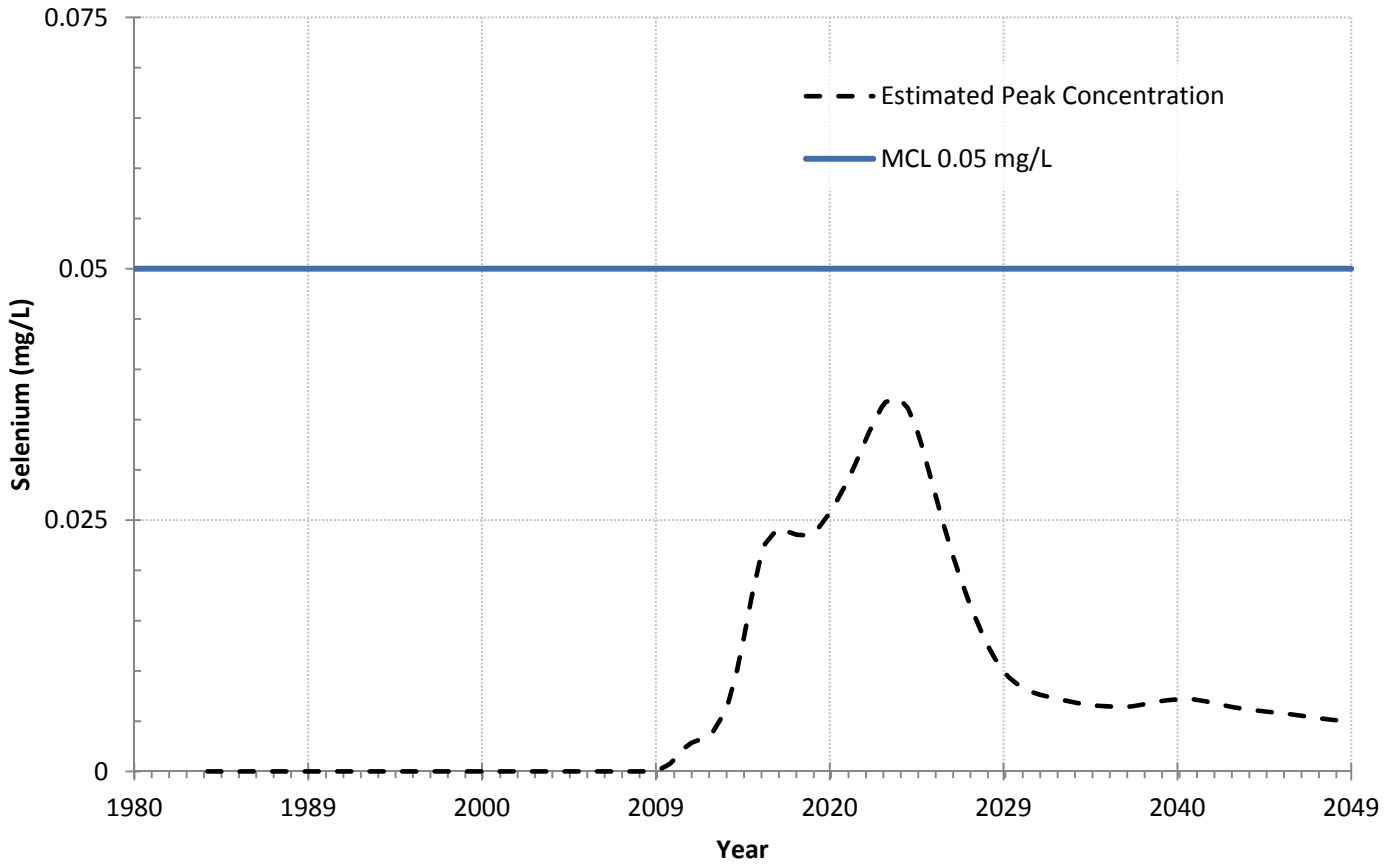
FIGURE 2-8

MODEL GRID CELLS REPRESENTING AREAS OF SELENIFEROUS BACKFILL (2012 CONDITIONS) OUTSIDE ASSUMED GW-IW CAPTURE ZONE

DATE: MARCH 2017	FORMATION ENVIRONMENTAL
BY:	FOR:

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig2_08_ModelGrid_v2.mxd

S:\Jobs\0442-004-900-Simplot-Smoky\RIFS\FeasibilityStudy\FSTM1\Fig2-9_SeConcNorthLeaseBndry.ppt



J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-9

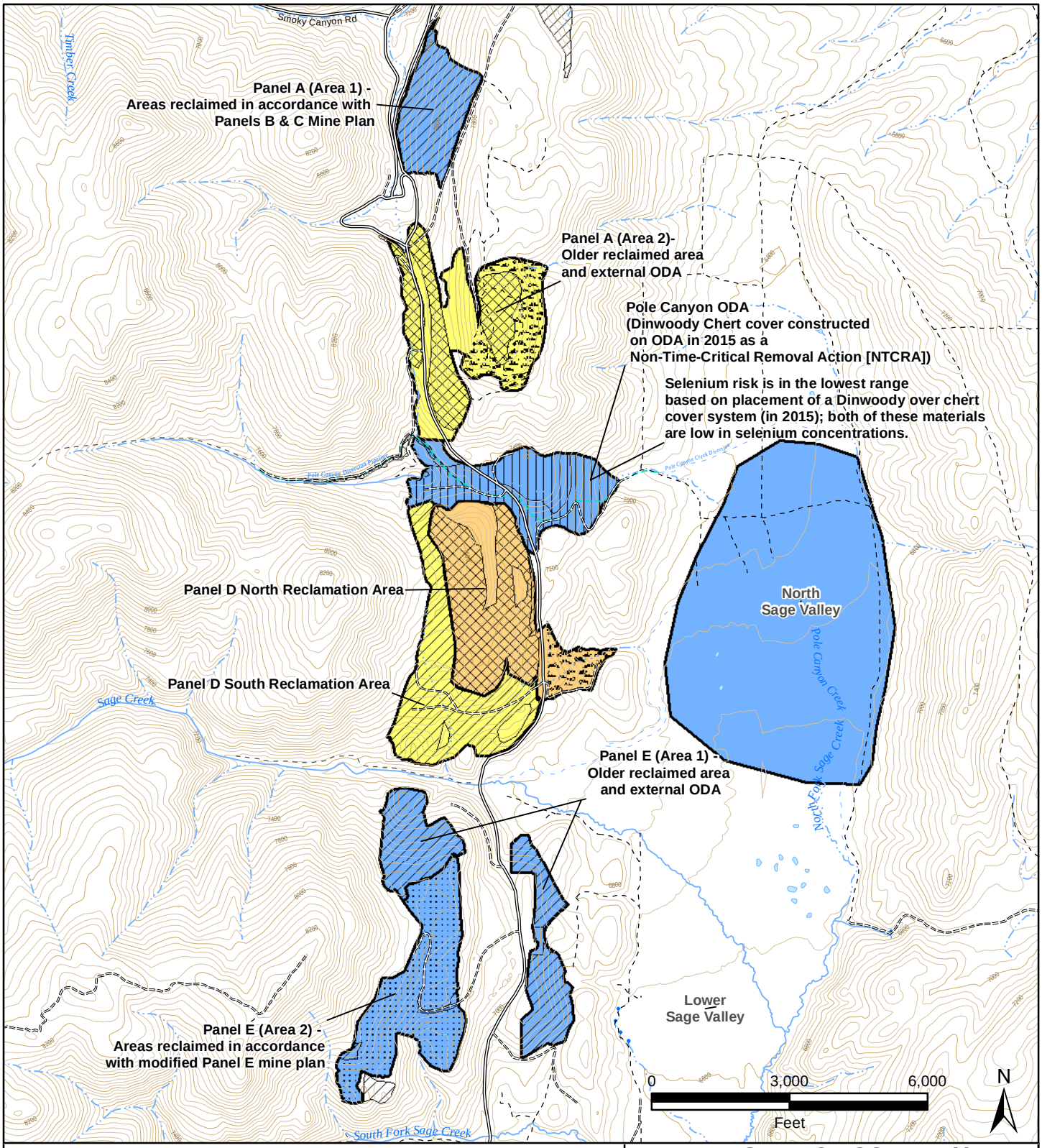
POTENTIAL SELENIUM CONCENTRATION IN GROUNDWATER AT THE NORTHERN LEASE BOUNDARY

DATE: MARCH 2017

BY: PHT | FOR: ACK

FORMATION ENVIRONMENTAL

S:\JOBS\0442-004-900-SIMPLOT-SMOKY\RIFS\RI_REPORT\REVDRAFT\FIGS\APPH\FIGH_5-37_PREDCONCENTRATION.PPTX



Legend

Cover Type

- DINWOODY CHERT (2015)
- TOPSOIL DINWOODY CHERT
- NO TOPSOIL NO CHERT
- TOPSOIL OVER CHERT
- TOPSOIL NO CHERT

Selenium Risk

- Lowest Risk
- Moderate - High Risk
- Highest Risk

- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

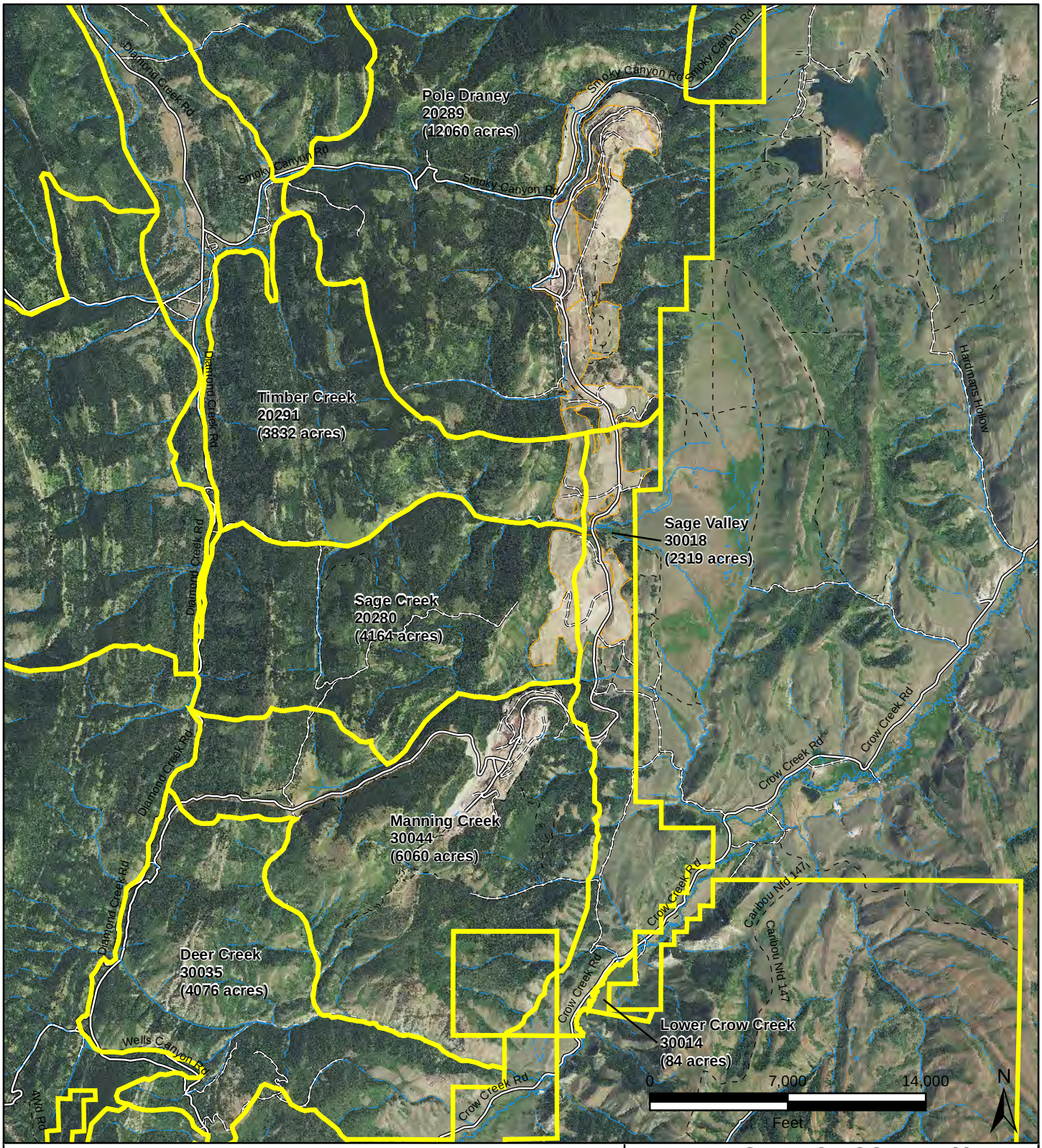
FIGURE 2-10

SUMMARY OF SELENIUM RISK TO TERRESTRIAL BIOTA

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig2_10_SeRiskSumm.mxd



Legend

- Grazing Allotment
- Perennial Stream
- Intermittent Stream
- Mine Disturbance Area (Panels A-E)

Allotments in vicinity of Smoky Canyon Mine are labeled.
Source: U.S. Forest Service (USFS). 2008. Range allotments shapefile - in Geographic Information System (GIS) coverages provided by Caribou National Forest, via e-mail. April 2008.
Aerial Source: 2013 NAIP photo from USDA

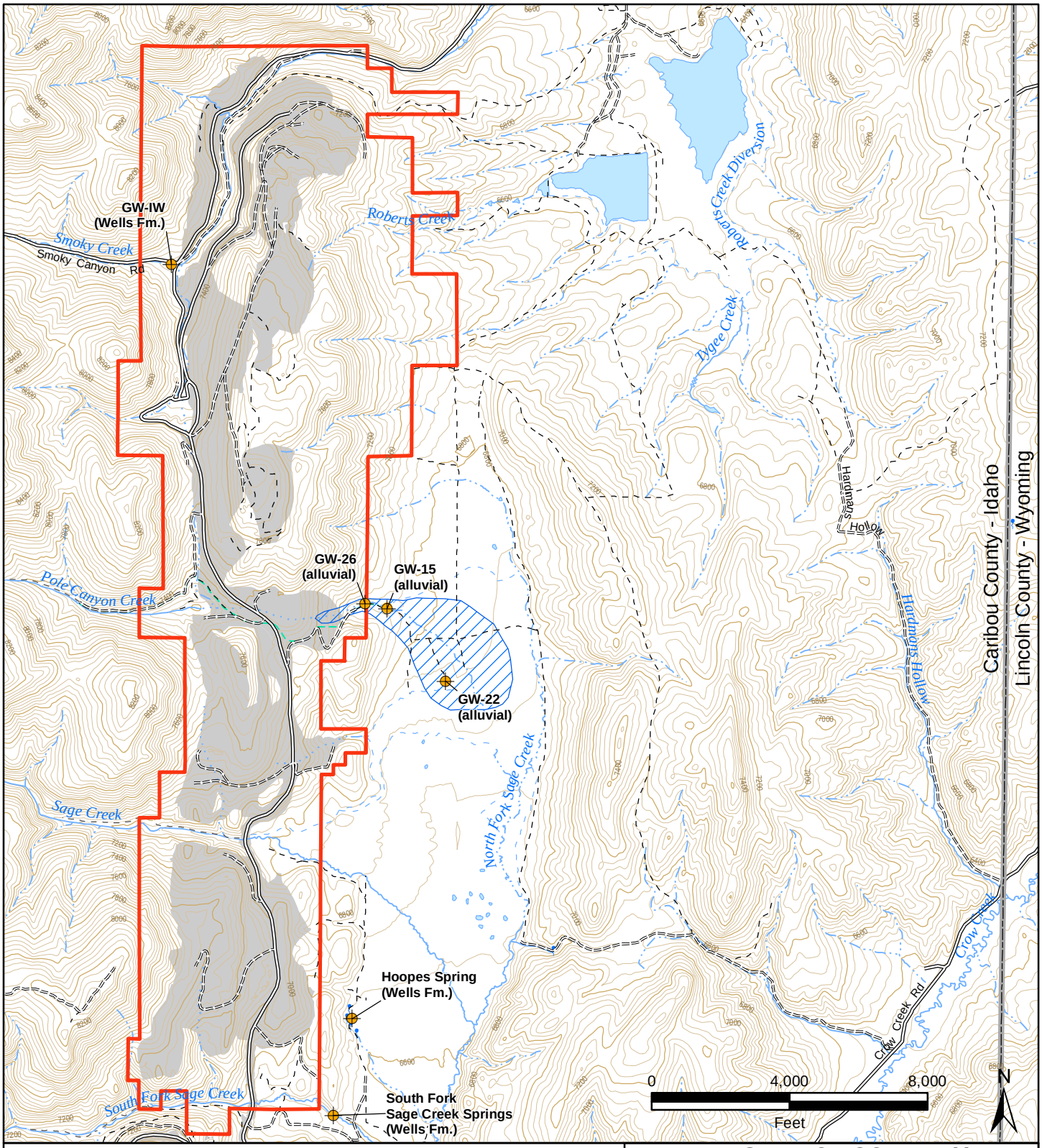
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 2-11

USFS GRAZING ALLOTMENTS - WITH SATELLITE IMAGERY

DATE: MARCH 2017		FORMATION ENVIRONMENTAL
BY: CRL	FOR: ACK	

S:\GIS\arcprj\20101109\pit\FS\TechMemo1\Fig2_11_Grazing-allot_wAerial.mxd



Legend

- Groundwater Monitoring Locations Exceeding Selenium MCL (0.05 mg/L)
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intermittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Lake/Pond
- Mine Disturbance Area
- Estimated Extent of Affected Alluvial Groundwater
- Lease Area

MCL = Maximum Contaminant Level (0.05 mg/L)

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

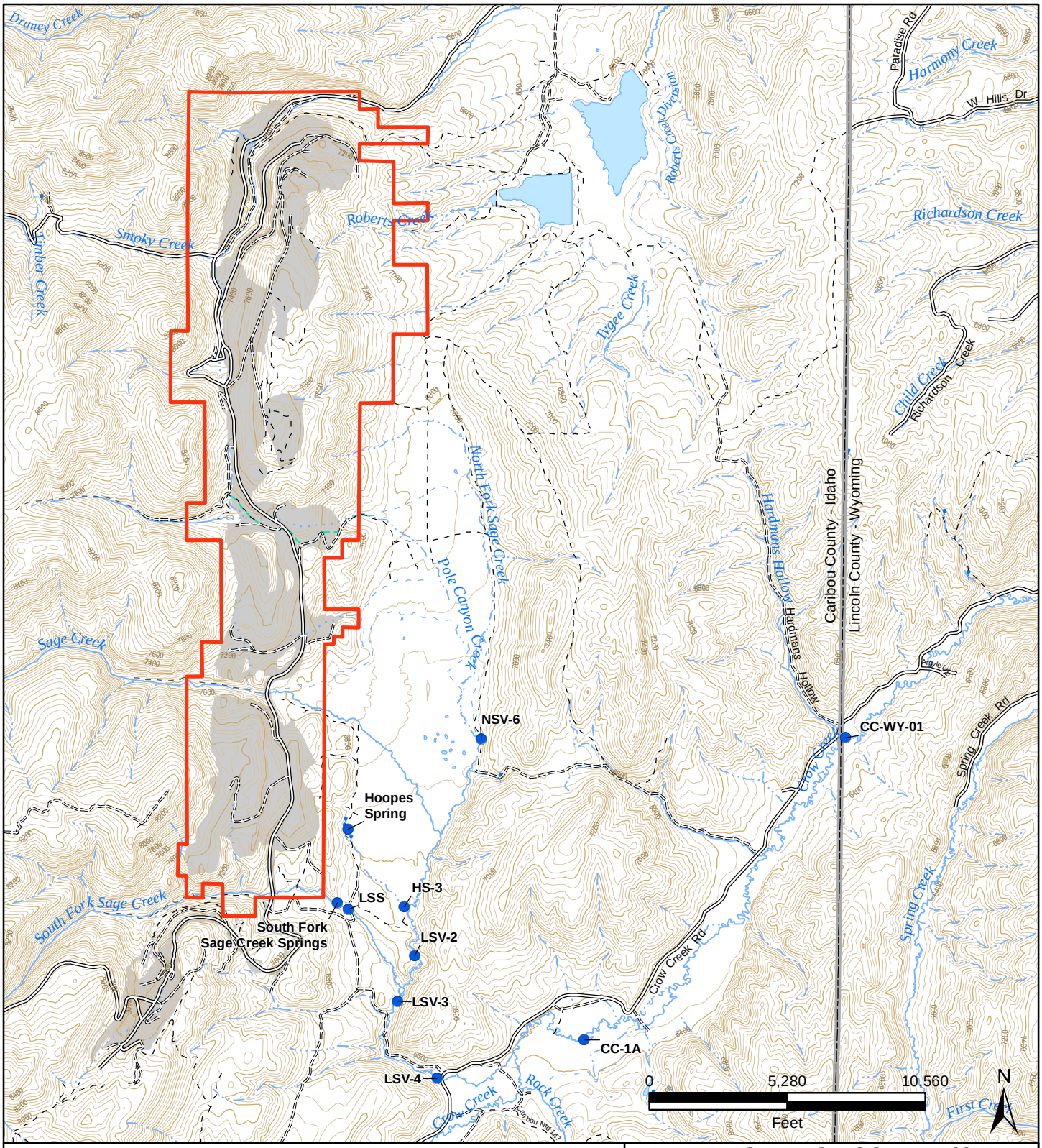
FIGURE 3-1

EXCEEDANCES OF SELENIUM MCL IN GROUNDWATER

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig3_01_Se_MCL_GW.mxd



Legend

- Surface Water Monitoring Locations Exceeding State of Idaho Surface Water Quality (Selenium) Criteria for Aquatic Life (0.005 mg/L)
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intermittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Lake/Pond
- Mine Disturbance Area
- Lease Area

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

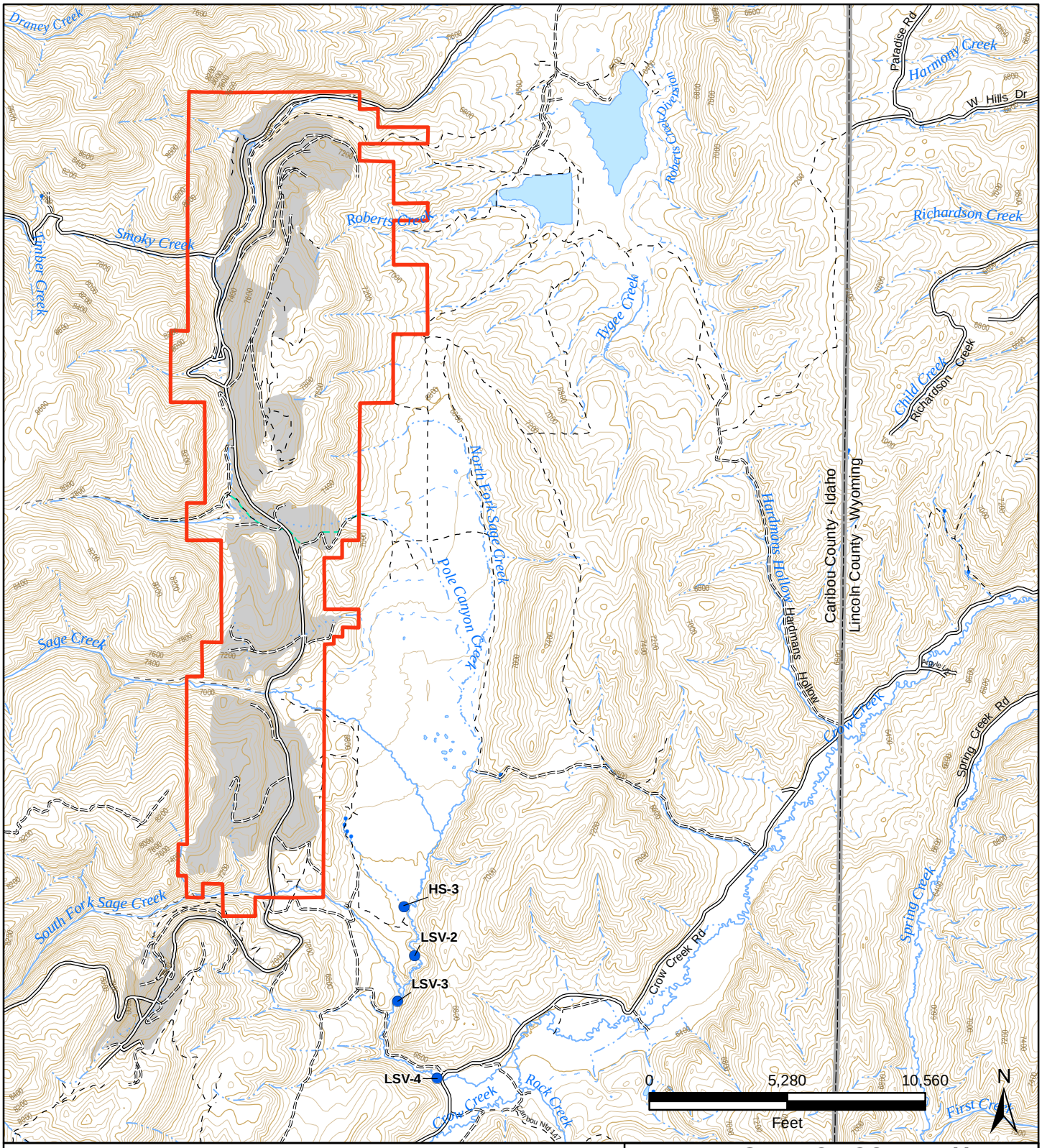
FIGURE 3-2

EXCEEDANCES OF SELENIUM CRITERION IN SURFACE WATER

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig3_02_Se_MCL_SW.mxd



Legend

- Surface Water Monitoring Locations with Elevated Selenium Risk to Aquatic Biota (Whole Body Tissue >13.2 mg/kg [USEPA-Derived] and >14.14 mg/kg dry weight [Simplot-Derived])
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Lake/Pond
- Mine Disturbance Area
- Lease Area

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

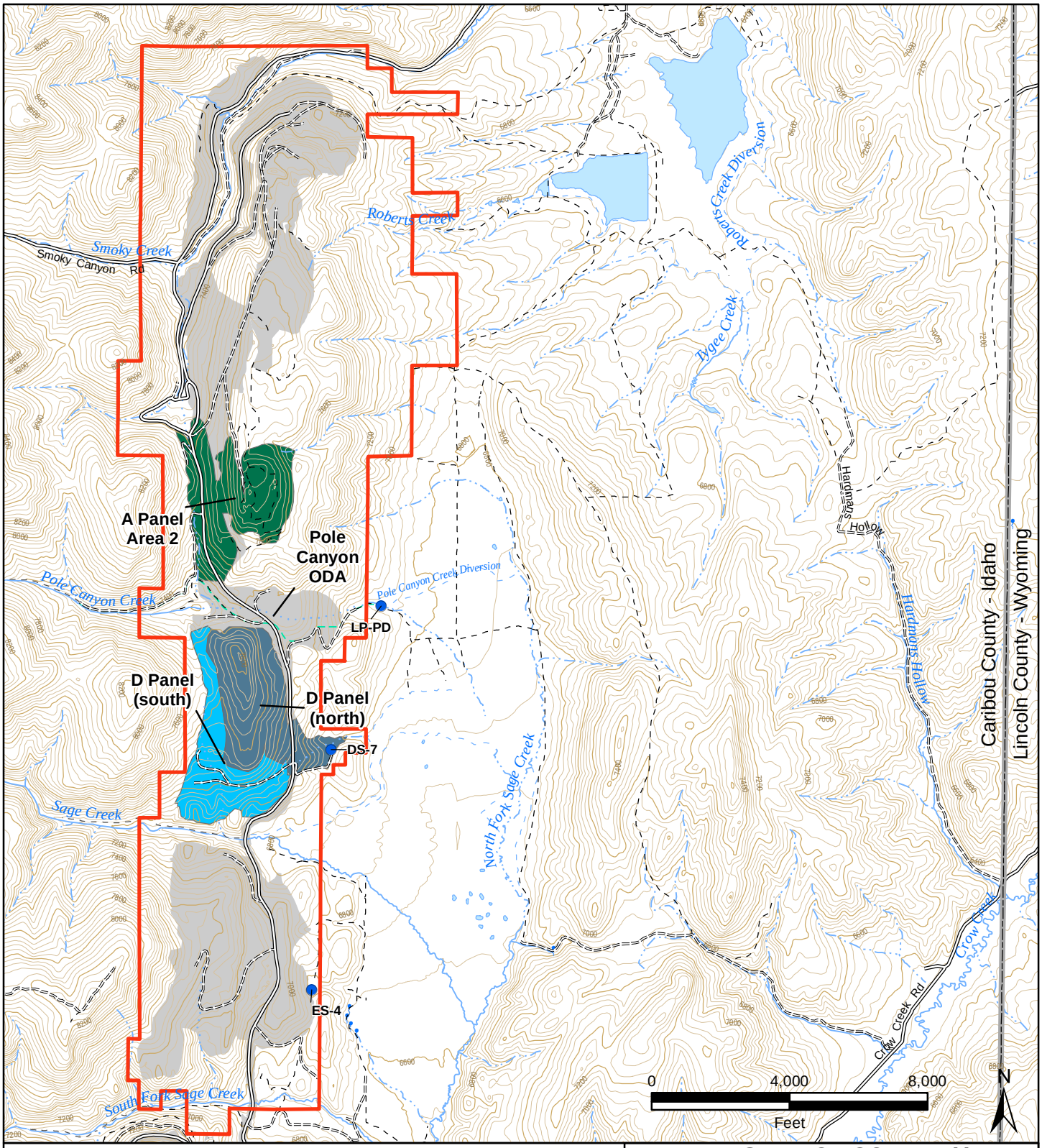
FIGURE 3-3

ELEVATED SELENIUM RISK TO AQUATIC BIOTA (WHOLE BODY FISH TISSUE)

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig3_03_Se_AqBiota_WholeBodyTiss.mxd



Legend

- Monitoring Locations with Elevated Selenium Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lease Area
- Lake/Pond
- Mine Disturbance Area

Sampling Areas with Elevated Selenium Risk

- Panel A (Area 2)
- Panel D (north)
- Panel D (south)

Note: Selenium risk to terrestrial biota on the Pole Canyon ODA has been eliminated as a result of the Pole Canyon ODA NTCRA cover constructed in 2015.

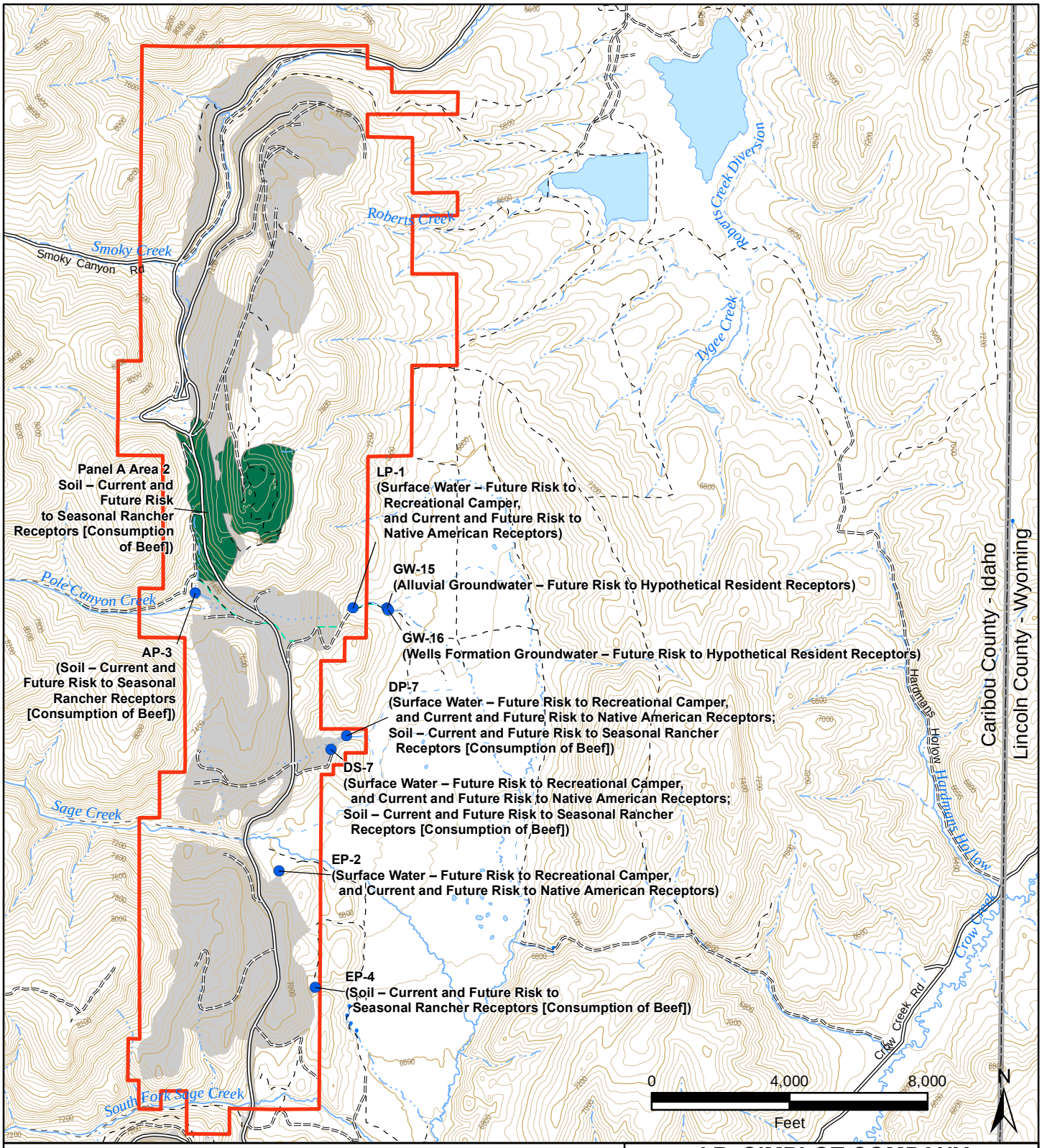
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 3-4

ELEVATED SELENIUM RISK TO TERRESTRIAL BIOTA FROM SOIL AND BIOTIC MEDIA

DATE: MARCH 2017		FORMATION ENVIRONMENTAL
BY: CRL	FOR: ACK	

S:\GIS\arcprj\20101109\plt\FS\TechMemo1\Fig3_04_Se_TerrBiota_SL_VG.mxd



Legend

- Monitoring Locations with Elevated Arsenic Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lease Area
- Lake/Pond
- Mine Disturbance Area

Sampling Area with Elevated Arsenic Risk

- Panel A (Area 2)

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

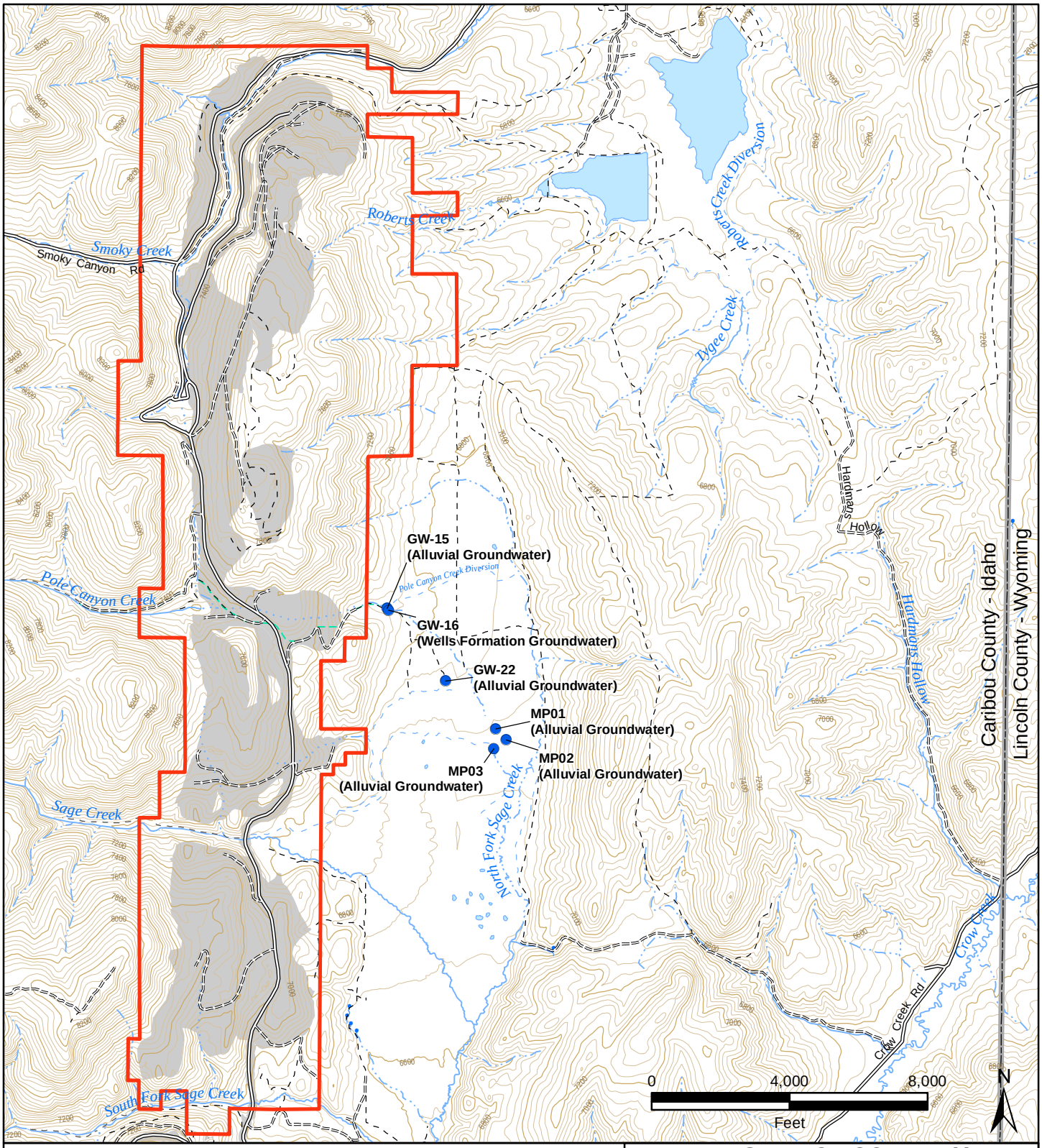
FIGURE 3-5

ELEVATED ARSENIC RISK TO HUMAN RECEPTORS

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\2010109\plt\FS\TechMemo1\Fig3_05_As_Human.mxd



Legend

- Monitoring Locations with Future Elevated Selenium Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lake/Pond
- Mine Disturbance Area
- Lease Area

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 3-6

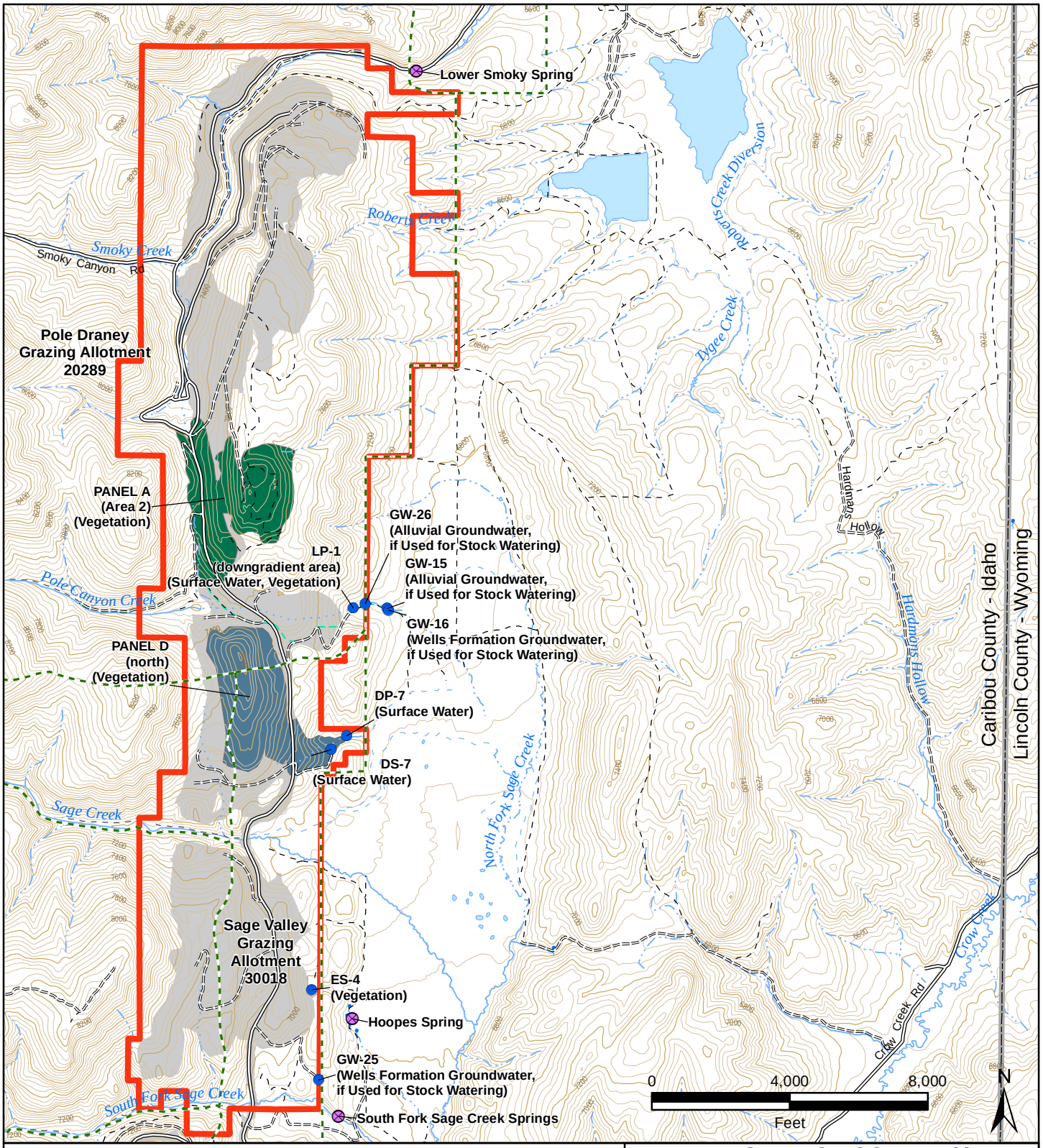
FUTURE ELEVATED SELENIUM DRINKING WATER RISK TO HYPOTHETICAL RESIDENT HUMAN RECEPTORS

DATE: MARCH 2017

BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\2010109\plt\FS\TechMemo1\Fig3_06_As_HypoRes_Human.mxd



Legend

- Spring Monitoring Location
- Monitoring Locations with Future Acute Selenium Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lake/Pond
- Mine Disturbance Area
- Grazing Allotment (USFS)
- Lease Area

Sampling Areas with Future Selenium Risk

- Panel A (Area 2)
- Panel D (north)

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 3-7

FUTURE ACUTE SELENIUM RISK TO LIVESTOCK

DATE: MARCH 2017
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj\2010109\plt\FSTechMemo1\Fig3_07_Se_Livestock.mxd

FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

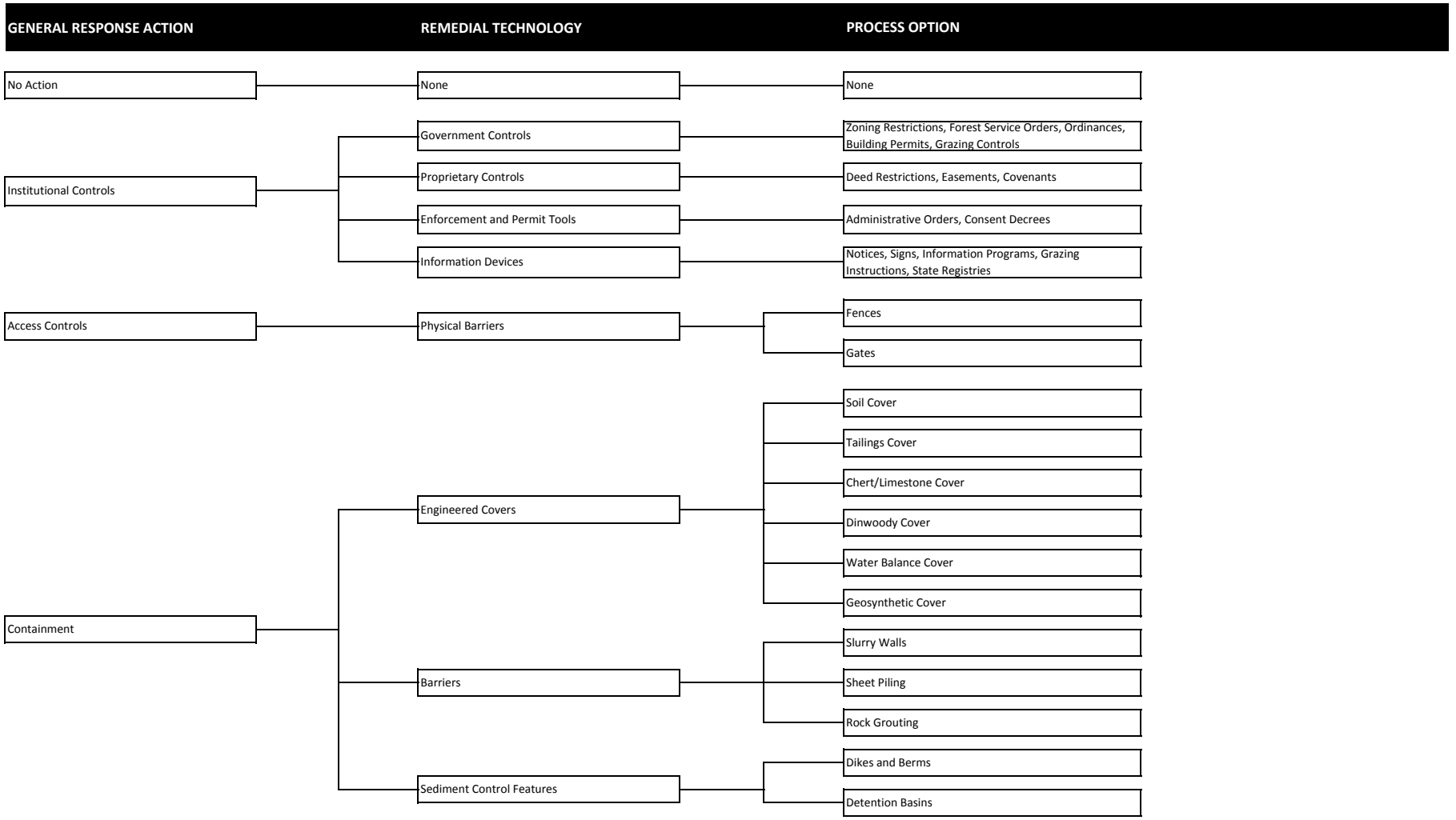


FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

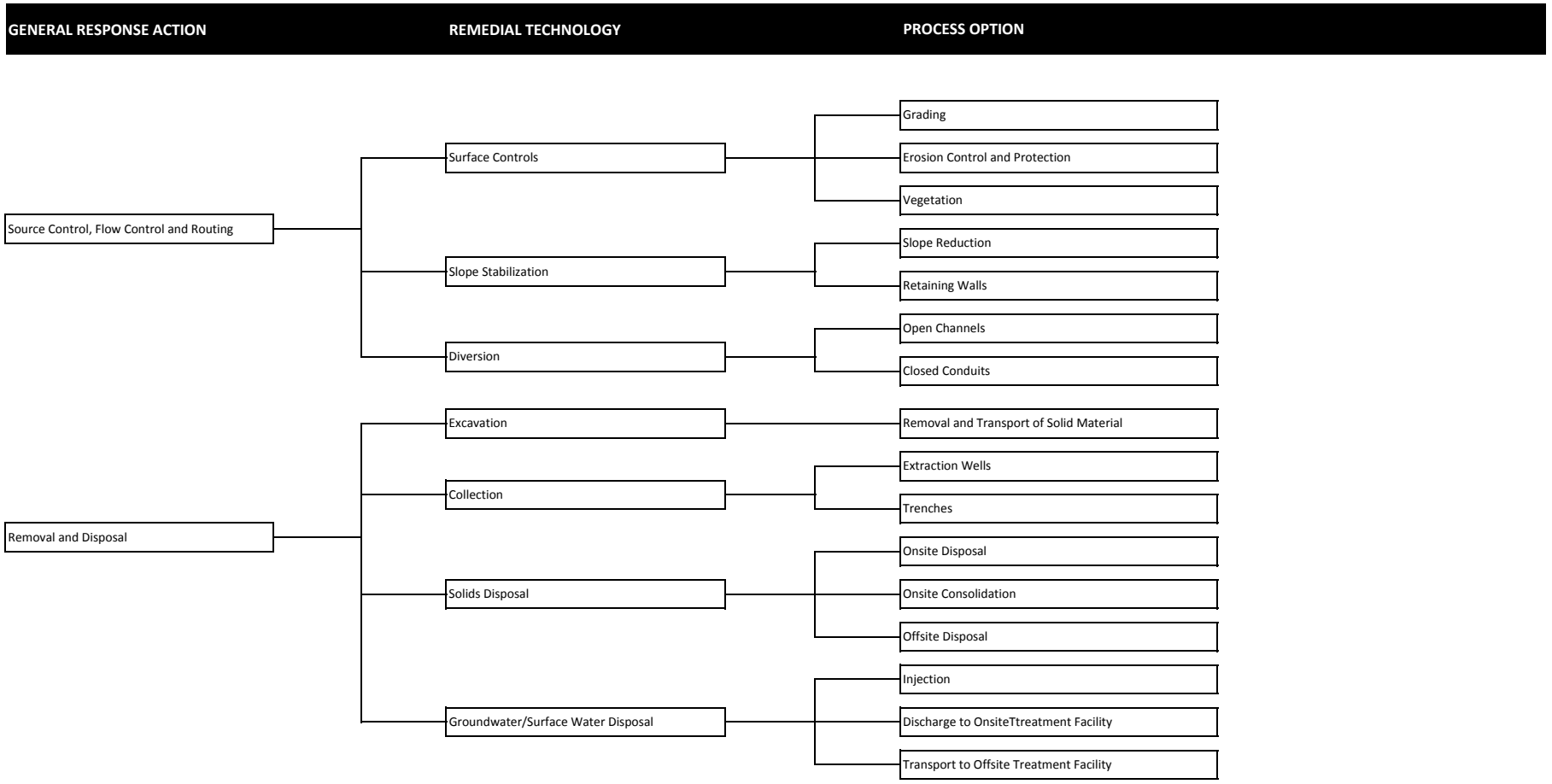


FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

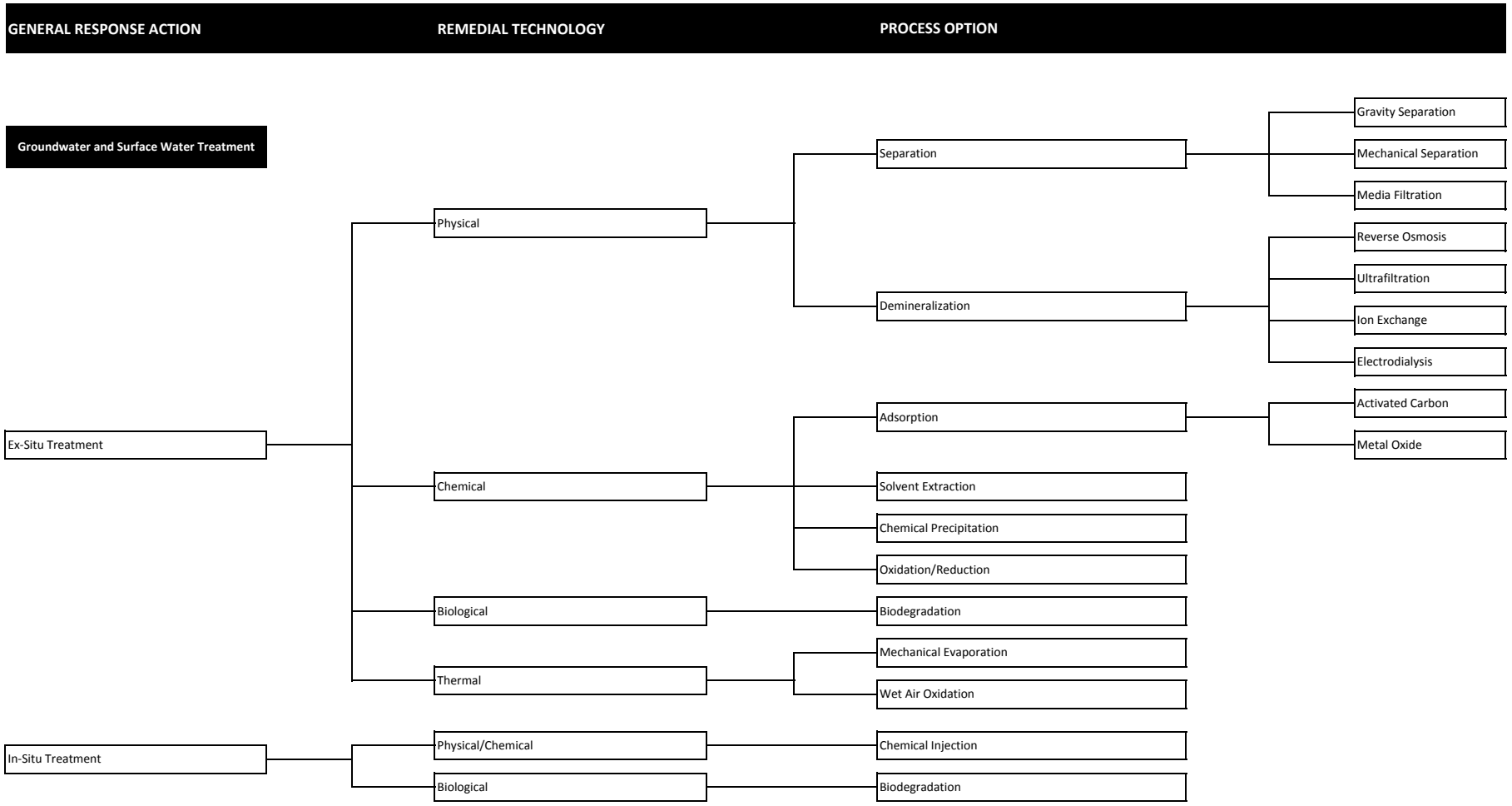


FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

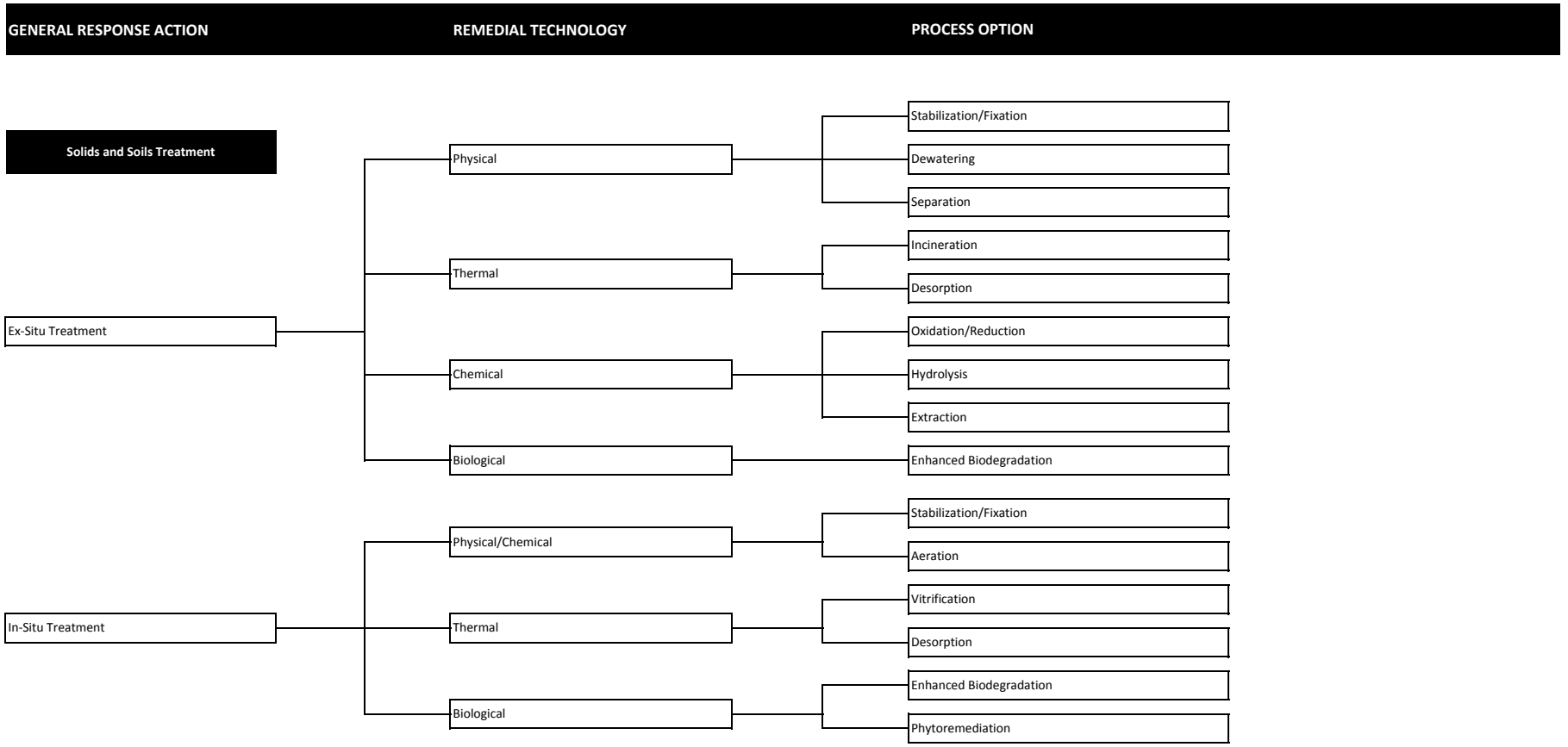
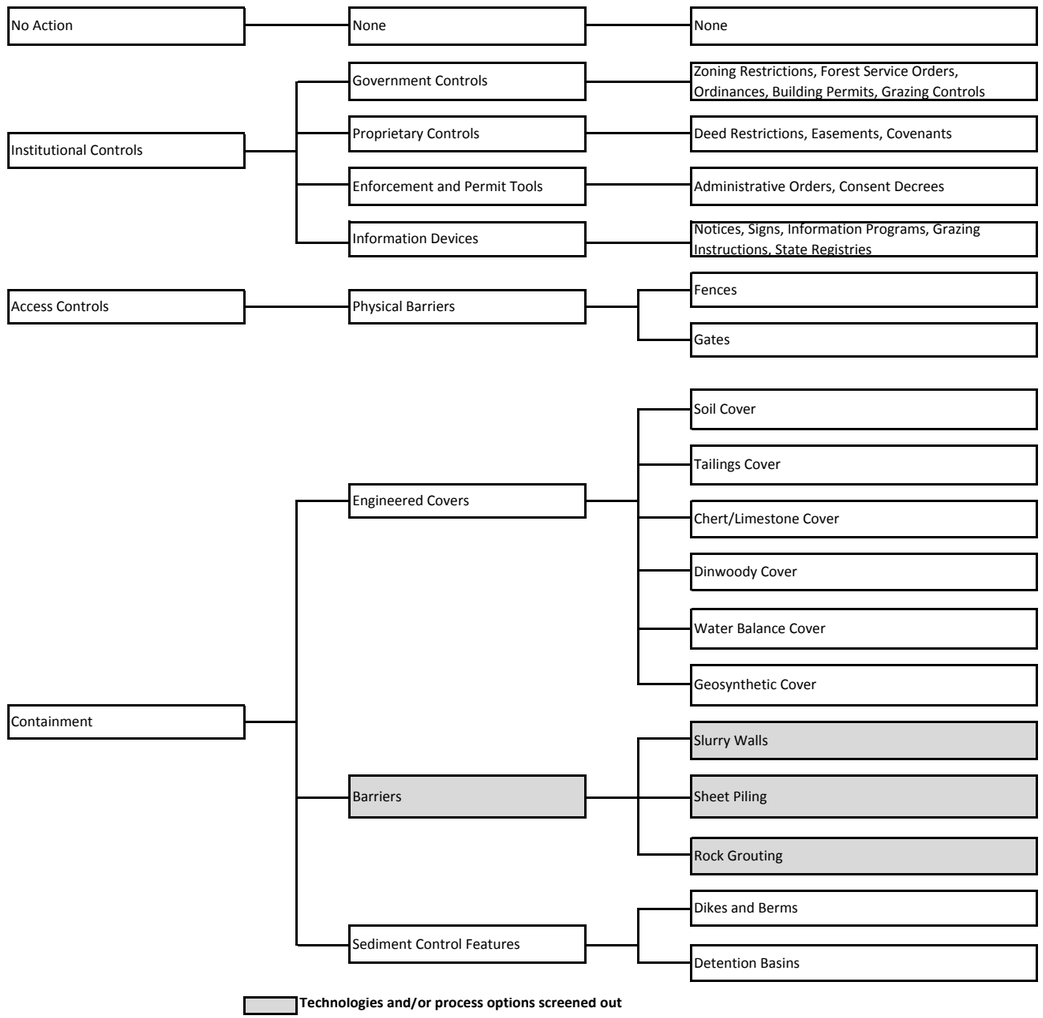
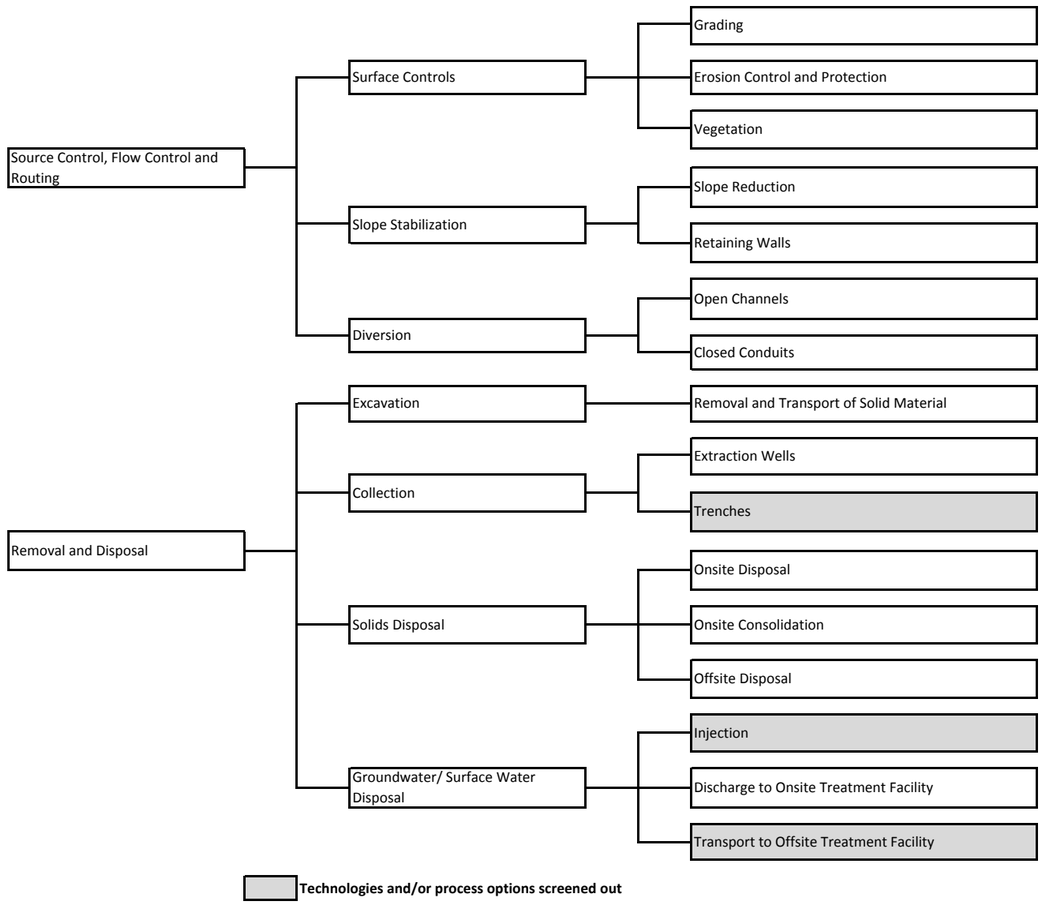


FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY



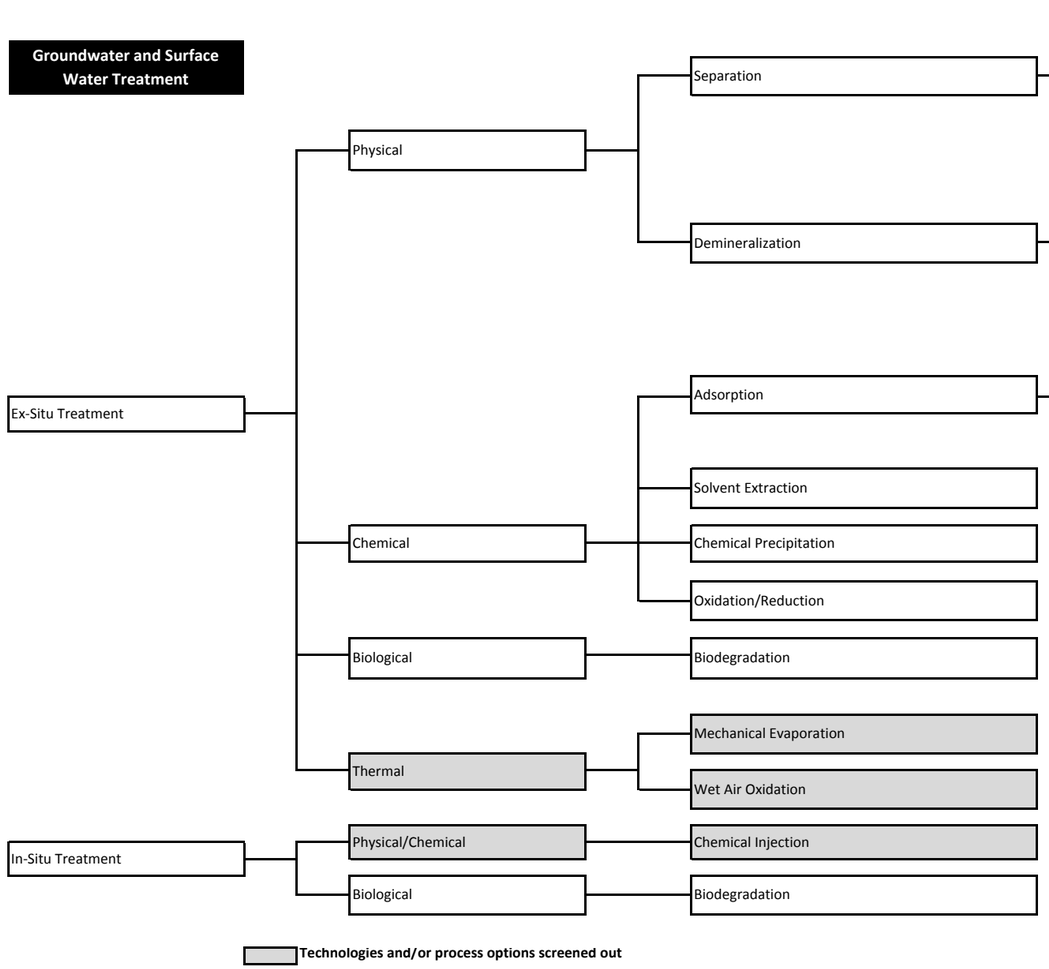
GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
No Action	None	None		No Action. Because previous work has occurred at Smoky Canyon Mine this becomes No Further Action.	No Action required by the NCP as a baseline for comparison.	Retained
Institutional Controls	Government Controls	Zoning Restrictions, Forest Service Orders, Ordinances, Building Permits, Grazing Controls		Federal, state, or county laws or regulations that restrict or control land or resource use.	Potentially implementable.	Retained
	Proprietary Controls	Deed Restrictions, Easements, Covenants		Deed restrictions prevent use of groundwater as drinking water and as stock tank water.	Potentially implementable.	Retained
	Enforcement and Permit Tools	Administrative Orders, Consent Decrees		Legal tools that limit ceratin activities or require the performance of specific activities.	Potentially implementable.	Retained
	Information Devices	Notices, Signs, Information Programs, Grazing Instructions, State Registries		Notification that residual or covered contamination remains at a site.	Potentially implementable.	Retained
Access Controls	Physical Barriers	Fences		Fixed structures that function as boundaries or barriers.	Potentially implementable.	Retained
		Gates		Fixed structures that limit access.	Potentially implementable.	Retained
Containment	Engineered Covers	Soil Cover		Soil cover layer to limit infiltration, reduce seepage, and reduce uptake of selenium by plants.	Potentially implementable.	Retained
		Tailings Cover		Tailings cover layer to limit infiltration, reduce seepage, and reduce uptake of selenium by plants.	Potentially implementable.	Retained
		Chert/Limestone Cover		Chert/limestone layer to provide a capillary break and minimize burrowing and root growth.	Potentially implementable.	Retained
		Dinwoody Cover		Dinwoody cover layer to limit infiltration, reduce seepage, and reduce selenium uptake by plants.	Potentially implementable.	Retained
		Water Balance Cover		Monolithic soil cover that temporarily stores precipitation and releases it by evapotranspiration.	Potentially implementable.	Retained
		Geosynthetic Cover		Clay and synthetic membrane (GCLL or GM) covered by soil to prevent infiltration and reduce seepage.	Potentially implementable.	Retained
	Barriers	Slurry Walls		Trench around ODAs or source materials filled with a soil bentonite slurry.	Not implementable due to the number of sources and depth/extent required to control groundwater.	NOT Retained
		Sheet Piling		Cutoff walls formed of wood, synthetics, pre-fabricated concrete, or steel.	Not implementable due to the number of sources and depth/extent required to control groundwater.	NOT Retained
		Rock Grouting		Pressure injection of grout in drilled holes or using vibrating beam method.	Not implementable because of the depth and extent required to control groundwater.	NOT Retained
	Sediment Control Features	Dikes and Berms		Grading the land surface to control surface water runoff and sediment mobilization.	Potentially implementable.	Retained
		Detention Basins		Basins or ponds used to allow sediment to settle out of storm water runoff.	Potentially implementable.	Retained

FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY



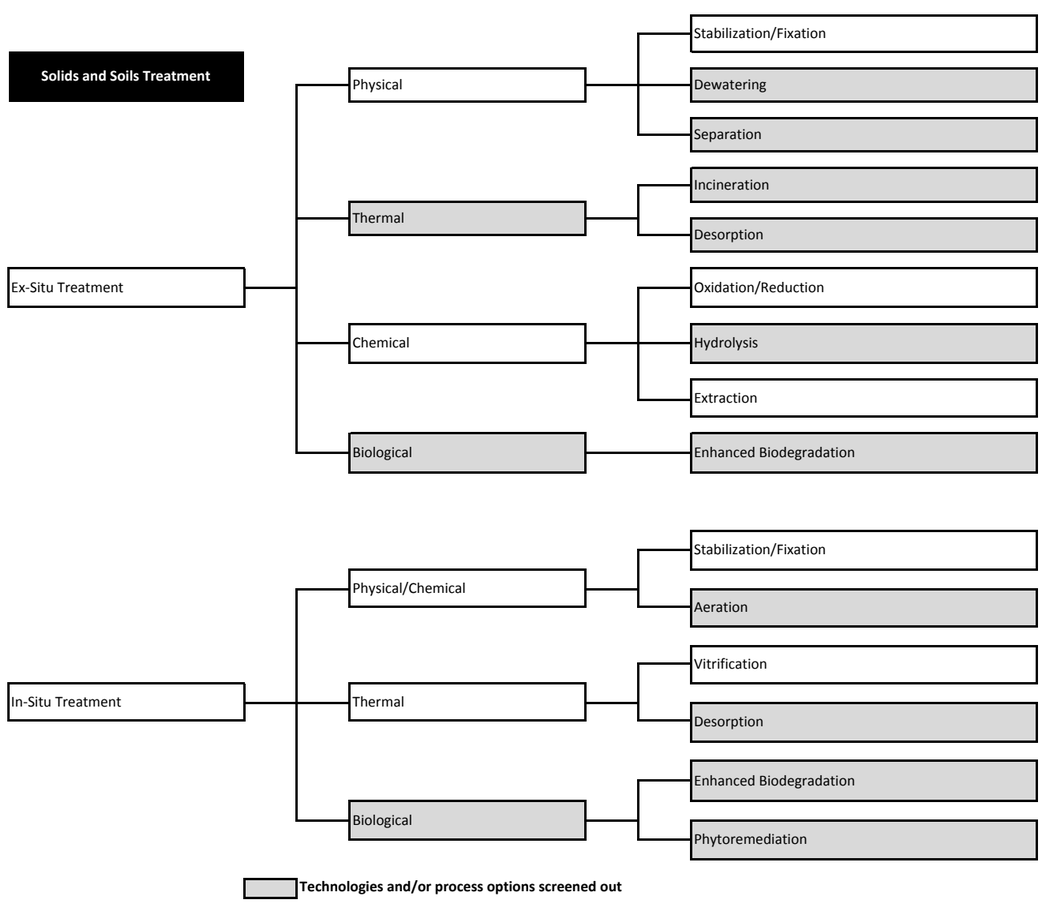
GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
Source Control, Flow Control and Routing	Surface Controls	Grading		Grading the land surface to manage surface water infiltration and runoff.	Potentially implementable in conjunction with other technologies.	Retained
		Erosion Control and Protection		Use of riprap, vegetation, and geosynthetic fabrics to reduce erosion.	Potentially implementable.	Retained
		Vegetation		Application of soil and seeding with native plants to reduce infiltration, runoff, erosion.	Potentially implementable in conjunction with other technologies.	Retained
	Slope Stabilization	Slope Reduction		Reducing the grade of surface slopes of backfilled pits and ODAs.	Potentially implementable.	Retained
		Retaining Walls		Vertical walls of steel, concrete, bricks, wood, or rock to stabilize steep slopes.	Potentially implementable.	Retained
	Diversion	Open Channels		Engineered canals or ditches constructed to convey surface water.	Potentially implementable.	Retained
		Closed Conduits		Culverts or pipes installed below ground to manage and control surface water.	Potentially implementable.	Retained
Removal and Disposal	Excavation	Removal and Transport of Solid Material		Excavation and transport of overburden/soils or sediments using earthmoving equipment.	Potentially implementable in conjunction with other technologies.	Retained
	Collection	Extraction Wells		Pumping well(s) used to control gradients and flow directions and to extract contaminated groundwater.	Potentially implementable.	Retained
		Trenches		Excavated ditches or channels to intercept and manage groundwater.	Not implementable due to the depth of the Wells formation aquifer.	NOT Retained
	Solids Disposal	Onsite Disposal		Identification of an onsite location for disposal of overburden/soils or treatment residuals.	Potentially implementable.	Retained
		Onsite Consolidation		Consolidation and relocation of overburden materials or treatment residuals and backfill/disposal in mine pits.	Potentially implementable for nonhazardous materials.	Retained
		Offsite Disposal		Disposal of hazardous material in a landfill offsite.	Potentially implementable.	Retained
	Groundwater/ Surface Water Disposal	Injection		Disposal of impacted water by injection into deep wells.	Not feasible to implement due to discharge of groundwater at creeks and springs.	NOT Retained
		Discharge to Onsite Treatment Facility		Routing and discharge of impacted water to a treatment facility onsite.	Potentially implementable in conjunction with treatment technologies.	Retained
		Transport to Offsite Treatment Facility		Transport of impacted water to a publicly owned treatment works (POTW) facility offsite.	Not implementable because there are no POTW facilities near the Site.	NOT Retained

FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY



GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
Groundwater and Surface Water Treatment	Physical	Separation	Gravity Separation	Separation of solids from a liquid using settling tanks, basins or other devices.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Mechanical Separation	Separation of solids from a liquid using a mechanical device such as a belt press.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Media Filtration	Separation of solids from a liquid typically using a granular media filter.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Demineralization	Reverse Osmosis/ Ultrafiltration	Physical treatment process in which pressurized water passes through a semipermeable membrane.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Ion Exchange	Cation or anion exchange resins used to remove ions from water.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Electrodialysis	An electric field used as the driving force for separating a liquid across a membrane.	Not implementable for inorganic constituents found in groundwater at the site.	NOT Retained
Ex-Situ Treatment	Chemical	Adsorption	Activated Carbon	Granular media filled vessels used to remove dissolved constituents from groundwater or surface water.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Metal Oxide	Vessels filled with zero-valent iron or activated alumina used primarily to remove arsenic.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Solvent Extraction		Separates constituents from a liquid by contact with another immiscible liquid.	Potentially implementable but may require further research to determine effectiveness.	Retained
		Chemical Precipitation		Chemical process where dissolved ions/salts are precipitated in the form of insoluble salts.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Oxidation/Reduction		Chemical reactions used to change contaminants to less toxic compounds.	Potentially implementable in conjunction with other treatment technologies.	Retained
	Biological	Biodegradation		Microorganisms used to degrade or reduce contaminants.	Potentially implementable.	Retained
	Thermal	Mechanical Evaporation		Water is mechanically heated to boiling and clean water is distilled off.	Not feasible due to the large water flow rates.	NOT Retained
		Wet Air Oxidation		Combustion reaction to break contaminated water and constituents down into base reaction products.	Not applicable to inorganic constituents found in groundwater at the site.	NOT Retained
In-Situ Treatment	Physical/Chemical	Chemical Injection		Chemical agents are injected into the impacted region of the aquifer to treat the groundwater.	Potentially hazardous byproducts, and complicated groundwater setting.	NOT Retained
	Biological	Biodegradation		Nutrients are injected into groundwater to encourage native microorganisms to metabolize contaminants.	Potentially implementable for inorganic constituents.	Retained

FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY



GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
Solids and Soils Treatment	Physical	Stabilization/Fixation		Excavated solids slurried with stabilization/ fixation agents to reduce contaminant solubility and mobility.	Potentially implementable to immobilize small volumes of solids/soils during the cover process.	Retained
		Dewatering		Separation of liquids from solids by various methods.	Not applicable for large volumes of overburden material.	NOT Retained
		Separation		Soils are slurried, and passed through a gravity separation process to extract inorganics.	Site conditions not conducive to this technology.	NOT Retained
	Thermal	Incineration		Energy applied to solids to combust organic constituents.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
		Desorption		Volatile compounds are separated or recovered from a solid or liquid matrix.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
Ex-Situ Treatment	Chemical	Oxidation/Reduction		Chemical reactions used to change contaminants to less toxic compounds.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Hydrolysis		Contaminants react with hydrolyzing agents resulting in decomposition of the chemical compounds.	Not applicable for removing selenium from solids and soils at the site.	NOT Retained
		Extraction		Multistage, intense scrubbing circuit used to wash and separate contaminated solids.	Not a proven method for inorganics but potentially implementable with further research.	Retained
	Biological	Enhanced Biodegradation		Slurrying solids with nutrient additives for degradation of constituents by microbial activity.	Not applicable for inorganic constituents.	NOT Retained
	Physical/Chemical	Stabilization/Fixation		Machinery is used to directly inject stabilizing agents, such as cement, into the soil.	Potentially implementable to immobilize small volumes of solids/soils during the cover process.	Retained
		Aeration		Aeration of soils is typically achieved by soil vapor extraction systems.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
In-Situ Treatment	Thermal	Vitrification		Solids or soils are electrically heated and fused into a stable, glass-like block.	Potentially implementable for small volumes of solids and soils.	Retained
		Desorption		Volatile compounds are separated or recovered from a solid or liquid matrix.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
	Biological	Enhanced Biodegradation		Nutrients are injected into soils to encourage native microorganisms to metabolize contaminants.	Not applicable for inorganic constituents.	NOT Retained
		Phytoremediation		Plants used to extract and concentrate organic constituents and metals/metalloids from soils.	Not applicable due to the presence of plant eating livestock and wildlife at the site.	NOT Retained

FIGURE 4-3. EVALUATION OF PROCESS OPTIONS FOR EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST

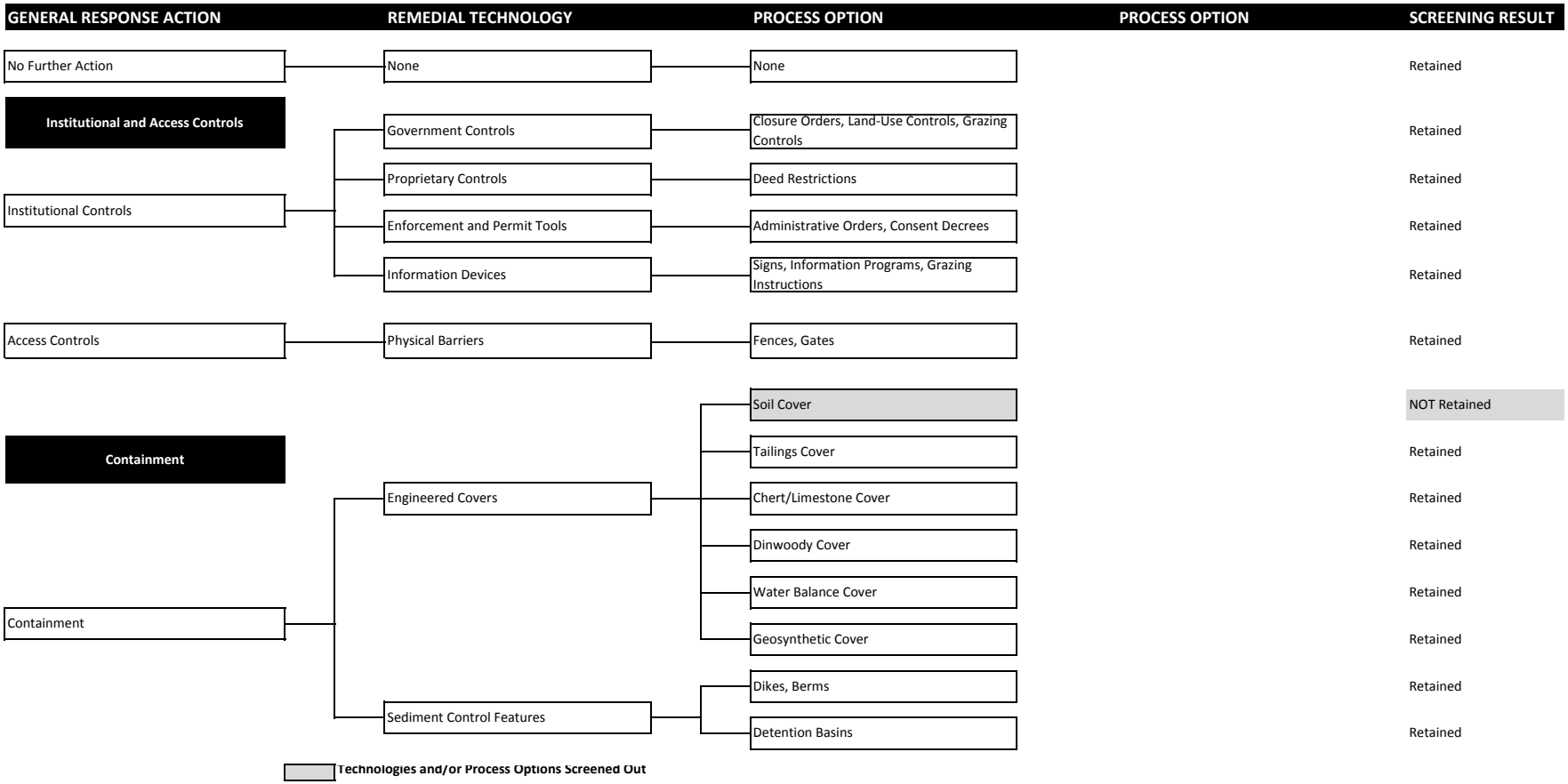


FIGURE 4-3. EVALUATION OF PROCESS OPTIONS FOR EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST

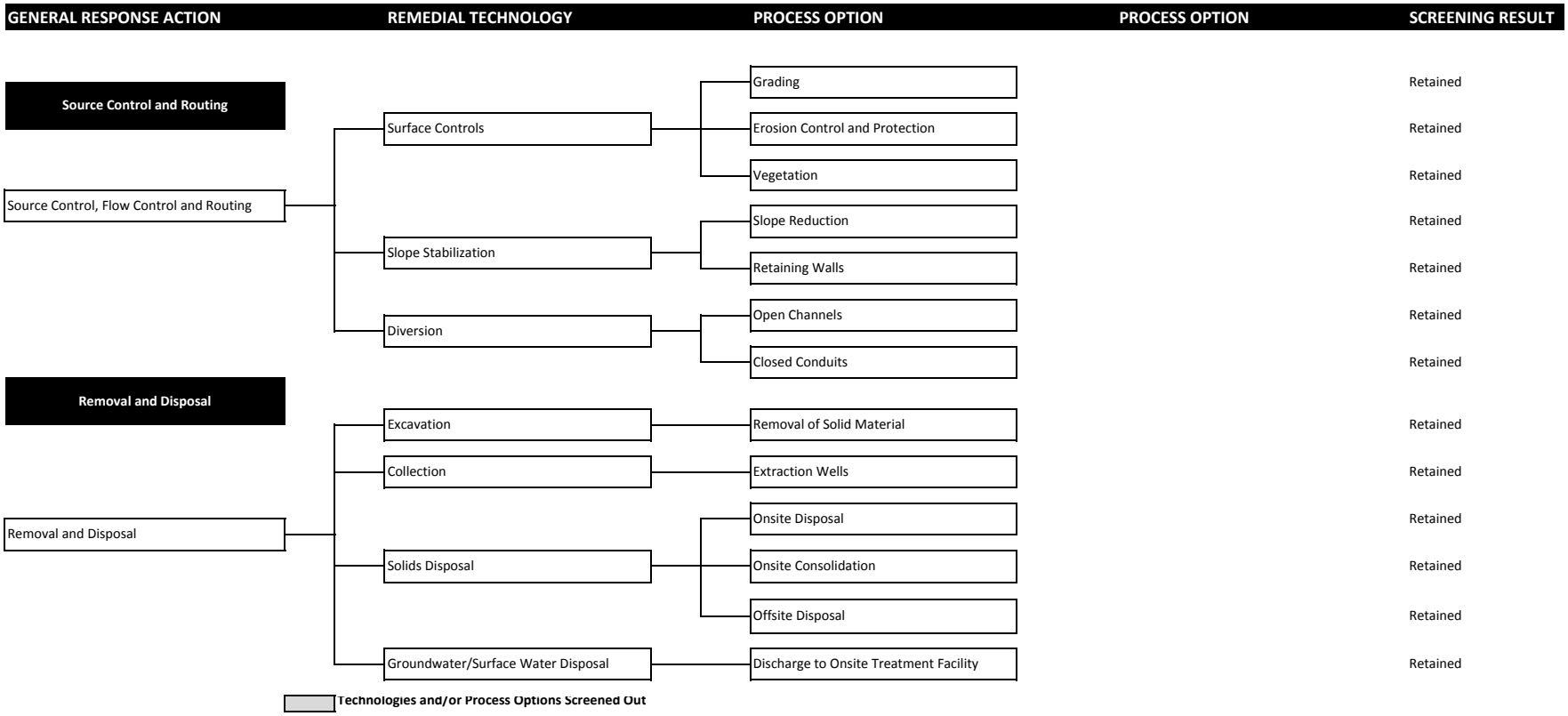
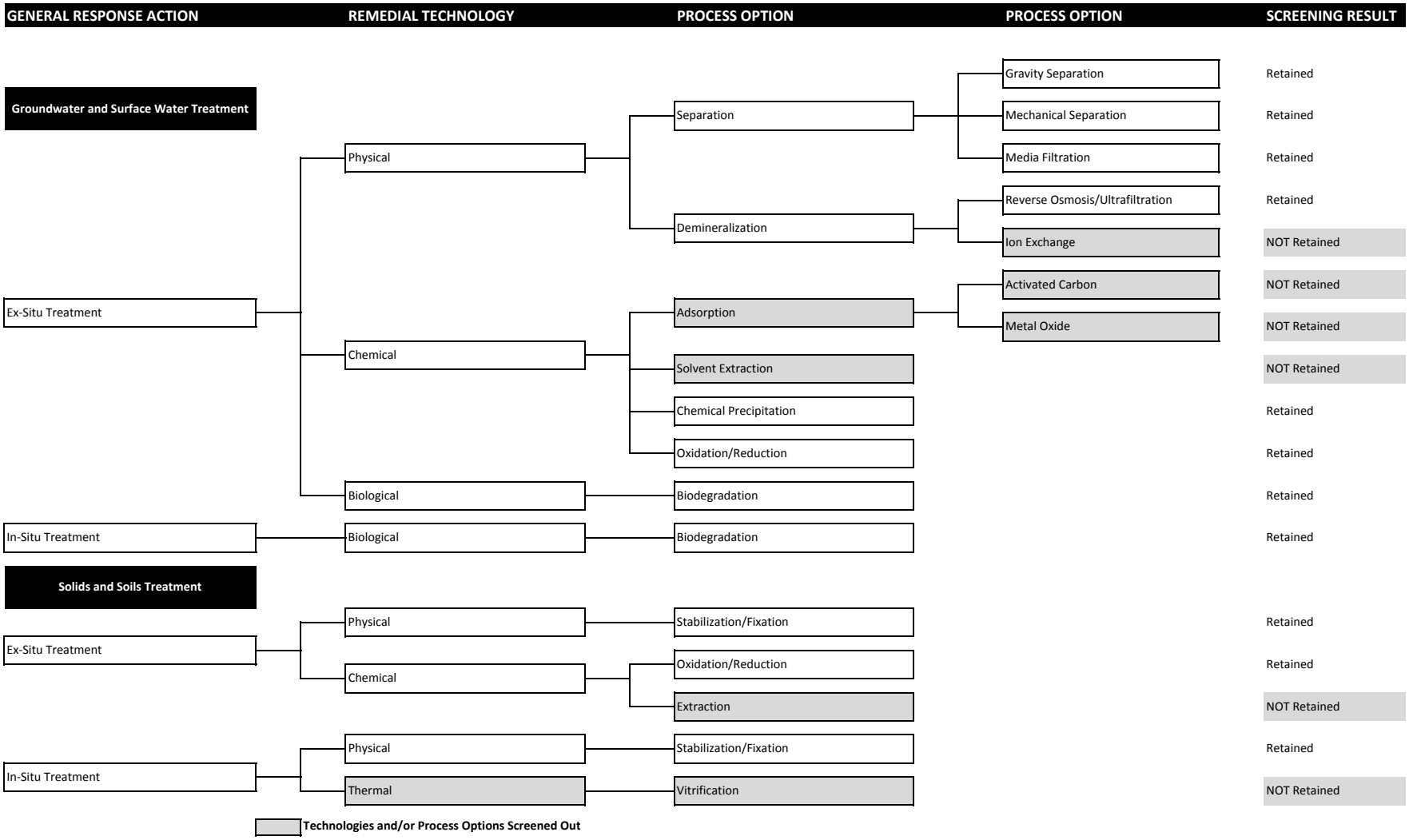


FIGURE 4-3. EVALUATION OF PROCESS OPTIONS FOR EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST



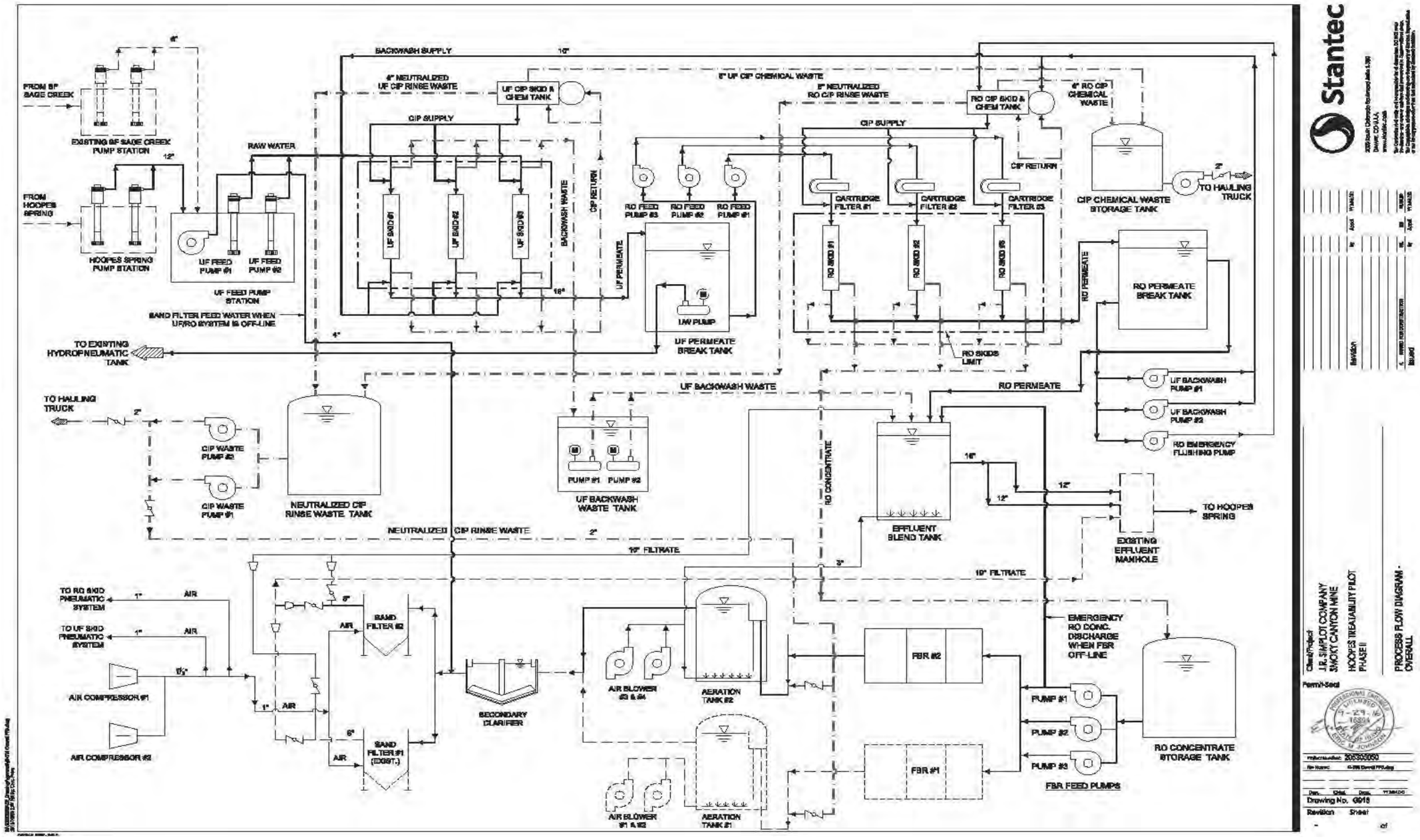


Figure 5-1. Hoopes Treatability Pilot Phase II Process Flow Diagram